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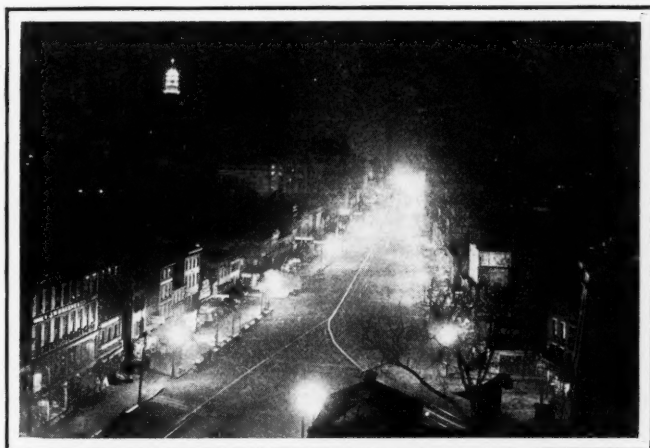
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LIGHTING NEW JERSEY CITIES

Public Service Corporation and Its Electric and Gas Plants—Formation of Company and Unification of Old Systems—Huge Power House and High Pressure Main—Business Methods



MARKET STREET, NEWARK, N. J., AT NIGHT

To supply the citizens of a State with illumination is a proposition of considerable financial magnitude, but the Public Service Corporation of New Jersey has practically undertaken this office and does now illuminate sections of the State containing three-quarters of its population. This corporation was formed several years ago by the combination of companies on whose plants millions of dollars had been spent; \$10,000,000 being paid in for stock of the new company. About \$20,000,000 worth of interest-bearing notes, beginning at a 2 per cent. rate and increasing to 6 per cent. at the end of ten years, were exchanged for \$59,000,000 of stock of four street railroad companies and one electric company. These railroad companies represented bonded investments of \$47,000,000 and \$15,000,000 stock of one leased company. The electric company represented bonded investments of \$19,000,000. Shortly after these purchases five companies, engaged for the most part in the gas business, were leased under conditions of small rentals increasing up to a period of eight years, after which the rate remained stationary, in most cases at 8 per cent. The stocks of the companies so leased amounted to about \$35,000,000, and their bonds to about \$36,000,000. In a general way, then, the Public Service Corporation has something like \$76,000,000 invested in railroads, \$71,000,000 in gas and \$25,000,000 in electricity. As about 35 per

cent. of the gas and electricity are used for manufacturing purposes, about \$62,000,000 may be considered as invested for purposes of supplying illumination to a territory occupied by about 1,300,000 people living in sixty cities and towns; a capital investment of about \$50 per inhabitant.

THE MARION ELECTRIC PLANT

As soon as the financial consolidation of the properties was accomplished, plans were made by engineers for consolidation and simplification of the power-generating system by the construction of tide-water plants of great capacity and high efficiency. Accordingly, a location was selected on the Hackensack river, at Marion, an important freight transfer point. This station has at length been finished, and is now in operation, to the extent of one-quarter of its ultimate projected capacity. For railroad work, two 5,000 kw. Curtis turbo-generators have been installed and one 3,000 kw. Curtis turbine generating a current of 13,000 volts has been put in operation. The current is generated at this high voltage for the purpose of economy in transmission. This plant is designed especially to provide for the needs of a territory east of the Hackensack river. At Newark there were tide water stations of high power. For lighting purposes there is, at the City Dock Station, one 3,000 kw. General Electric Curtis turbo-generator, 6,600 volt, 60 cycles, three phases. The steam is supplied by Babcock & Wilcox boilers, run under a pressure of 155 pounds. Besides the turbo-generator, there are, at this station, seven Westinghouse 850 kw., 2,300 volt two-phase, 60-cycle generators, each direct connected to a Pennsylvania Iron Works horizontal cross-compound condensing engine, and one Westinghouse 500 kw., 550 volt, direct current generator, direct connected to a Watts-Campbell horizontal, cross-compound condensing engine. These engines are supplied with steam from a battery of Climax boilers, all run under a pressure of 150 pounds. This station, by far the largest light and power station in the system, is connected with Marion and Jersey City Stations, in such a way that each may reinforce the other. As a matter of fact, at the present time, the City Dock Station generally supplies power to Jersey City stations, while later on, when de-

mand in the Newark and adjacent territory is greater, and further development of the Marion plant make it possible, it is likely that these stations will be called on for power for Newark.

THE MORGAN STREET SUB-STATION

Along with the development of the large central power station, the substitution of sub-stations for small or old-fashioned stations goes on. The most notable instance of this change is the use of a sub-station now building at Morgan street for the two old stations at Grand and Wayne streets. The Grand street station is exclusively a railroad station and will not be described. The Wayne street plant is for lighting, and a comparison of it with the new plant may be made to show why a station, although in good working order, is considered sufficiently obsolete to be abandoned. This plant consists of five Climax boilers, run under a pressure of 150 pounds, one Corliss and three other engines, belted to a jack shaft and operating a dozen or more generators of various makes and capacities. All this machinery is contained in a large shed 150x200 feet, with high roof and wooden floor. Practically all the work done by both this and the Grand Street Station will be performed by current generated at Marion and transformed and distributed by the new sub-station on Morgan street, right in the heart of Jersey City. Machinery for

this work will be contained in a neat building, with pressed brick front, 90x45 feet floor space, and 28 feet high. The floor is of reinforced concrete. This building will contain rotary transformers, General Electric 500 kw., for railroad use, receiving current at 13,000 volts, alternating, and sending it out at 600 volts direct. For incandescent lighting there will be seven 375 kw. air-cooled transformers, receiving current at 13,000 volts, and sending it out at 2,200 volts, both alternating.

A Sturtevant Blower compresses air under a half-ounce pressure in a chamber below the floor, whence it escapes through openings over which the transformers are placed, the current of air preventing overheating and melting of the insulation. A 1,500-ton crane will be kept permanently in position to facilitate repairs. It is estimated that the loss in transforming current is only 2 per cent. Whatever the advantages of this system may be to the lighting company, its advantage to the public is obvious. In the place of a large, unsightly, smoky power house, is an unobtrusive little building that might readily be mistaken for a public building of any sort. The Newark and Marion plants, connected by cables and reinforcing each other as described, are the principal factors in generating power and light for the northern New Jersey region. From these plants and some smaller stations still in use a number of cities and towns are supplied.

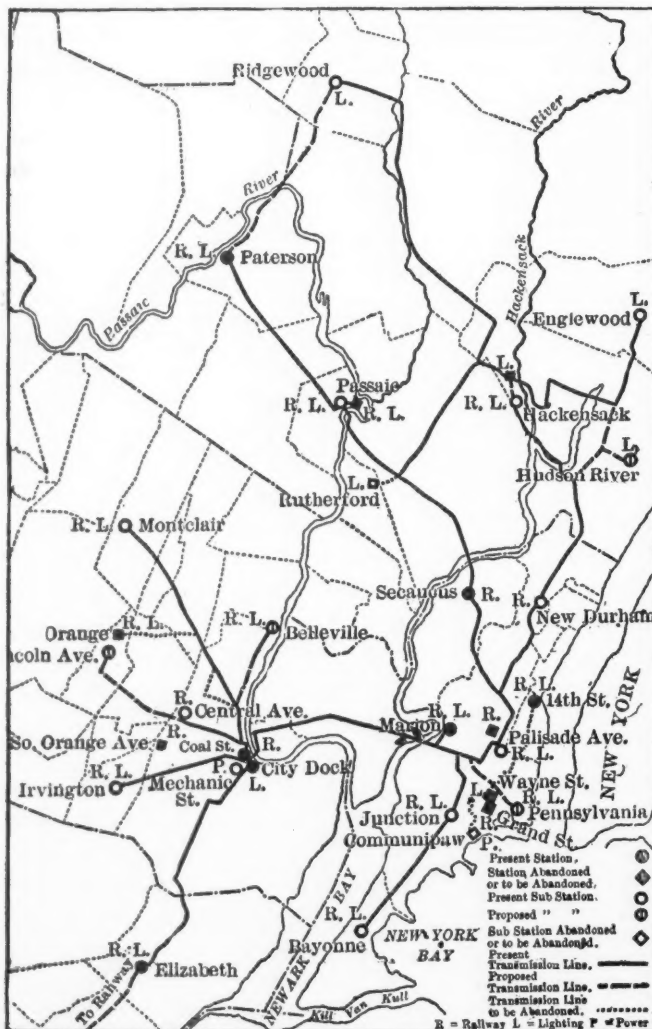
CENTRAL AND SOUTH JERSEY SYSTEMS

For the Central New Jersey region power is now supplied from a central station at Metuchen and from these transmitted to sub-stations situated from four and a half to nine miles away, the largest of which are at New Brunswick and Plainfield. The stations replaced were old single unit plants, with counter shafting and slow-speed simple engines. The main units of the Metuchen station are turbo-generators. The South Jersey System consists of stations at Trenton and Bristol, which are provided with generators of various styles, direct connected to engines, and the station at Camden with turbo-generators. The Camden station supplies five sub-stations, and a similar movement toward simplicity and concentration in power plants is likely to go on throughout the whole field.

The lighting departments of the Public Service Corporation are now conducting experiments to determine their loss of current and of gas. Many electrical distributing systems lose 50 per cent., but this system is roughly estimated to account for 75 per cent. of the power that leaves the station. The Gas Department of the same company claims to account for 90 per cent. of gas.

EXTENT OF BUSINESS DONE

The number of lamps in actual use is no longer known, as, with the use of watt meters, it has become unnecessary to count lights. In a general way, it may be said that the company operates about one million and a half of lamps of 16 candle power, or the equivalent thereto, on an estimated basis of 20 lamps per kw. The total average production of the whole system for all purposes is 166,000,000 kwh., of which about 22,000,000 kwh. are sold for commercial light and power purposes.



MAP OF NORTHERN NEW JERSEY, SHOWING STATIONS AND DISTRIBUTION SYSTEM

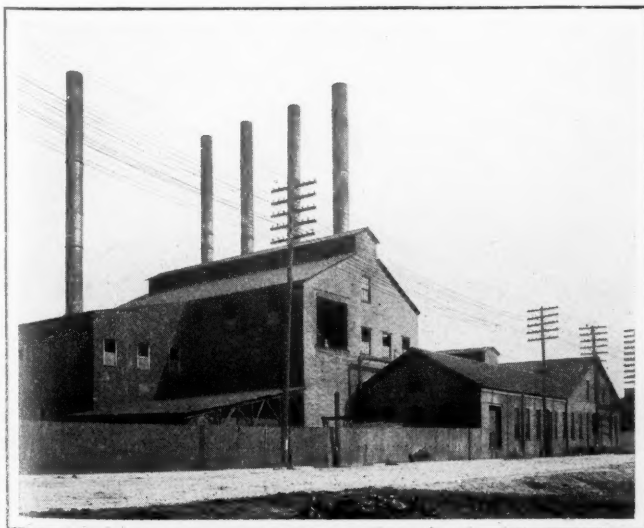
To increase the business of the company throughout its three divisions, Northern, Central and Southern, at the rate of about 20 per cent. each year, as has actually been done, requires most able management, and the business methods of the departments are therefore interesting. Canvassers are employed in search of business throughout the territory. Interesting advertising matter is sent out by a special publishing agent to possible customers. Moreover, certain kinds of lamps are supplied to customers with no charge except for current. When ordinary incandescent lamps are found insufficient, clusters of from three to six are recommended. If these lamps are not satisfactory, the Nernst lamps, made by the Westinghouse Company, Pittsburgh, are next put in. This lamp burns four glowers and is of about 300 candle power capacity. It takes a 220-volt current and at the full rate of 12 cents per kw. is estimated to cost $4\frac{1}{2}$ cents per hour. The manager of this department reports that he finds this lamp very satisfactory to customers, many of whom had previously been taking gas from another department of the company. The life of the lamp has not yet been satisfactorily determined, and as the company bears the cost of maintenance, this is quite an important matter. The ordinary incandescent arc (General Electric or Adams-Bagnall), which consumes 6 amperes a. c. per hour, 110 volts, and gives 450 to 500 candle power, is also put in on the same terms. The cost is estimated at 6 cents per hour. While all costs are figured at the maximum rates, in reality a sliding scale is in force. This affects the retail as well as the wholesale consumer. The retail consumer is charged 12 cents for the first hundred kwh. used and 9 cents for each additional kwh. To the customers classed as wholesale 8 cents is charged per kwh. for current supplied over 100 kwh. and under 500 kwh., 7 cents up to 1,000 kwh., 6 cents up to 1500 kwh., and 5 cents up to 2500 kwh.

Electric signs are growing in favor and are offered to customers on annual contracts, free of cost, except for current. These signs, which cost from \$100 to \$250 each, are of the monogram type, made by the Mobile Electric Co., and have generally ten lamps of four candle power in each letter. A panel sign made by the United Electric Co. has

24 lamps in all instances. The Moore Tube is another light for which there is a growing demand in factories and in certain places for which the character of the light is considered superior. This lamp is claimed to produce light for one-sixth of the cost of ordinary arc lighting. The cost of the tube is \$250 for 50 feet and \$300 for 100 feet. Some flaming arc lamps have been put in at a cost of \$67.50 per lamp, but their use has not been extensive. The question of maintenance of a high-efficiency light is an important one. As in the case of private lighting, there has been a progressive reduction in the cost of public lighting since the Public Service Corporation assumed charge of the properties. The prices now are far from uniform, however. For instance, Paterson pays \$85 for arc lights and Camden \$109.50. For incandescent lamps from \$15.50 to \$18 is charged. It is announced, however, that uniform rates for arc lamps will be made varying from \$75 to \$85 for 2000 candle power lamps, according to the size of the city in which they are supplied.

THE GAS PLANT

The operations of the Public Service Corporation in the field of gas illumination cover about the same field as do those of the Electric Lighting Department. The North Jersey section is, of course, the most important, including as it does two large cities and many smaller ones. The Central Jersey field is being consolidated with the South Jersey division by the extension of a large gas main from Camden. In the North Jersey section there has been no concentration of productive capacity in large plants, but the old ones have been extended and improved. The largest plant in the system is in Newark, where is located the largest gas holder, a receiver of 3,000,000 cubic foot capacity. In Jersey City a 2,000,000 cubic foot receiver has recently been completed by the R. D. Wood Company of Philadelphia. Large holders such as those that are in the course of construction in New York City, having capacities up to 15,000,000 cubic feet, are not favored by the Public Service officials. The value of land and necessity of securing the maximum storage in proportion to the space occupied is not considered sufficient to compensate for the risk of storing so great an amount in a single unit.



THE OLD PLANT AT WAYNE STREET



THE NEW MORGAN STREET SUB-STATION

Different processes of manufacture are in use in various plants. The Newark plant contains 198 retorts, each using about a ton of coal a day. The coke that remains from this process is used for manufacturing of water gas, the essential feature of which is the blowing of steam upon incandescent carbon. This plant has just been equipped with a valuable labor-saving device, the Bronder charging machine. The gas retorts, which are long pans with rounded bottoms placed in the furnace, require about 300 pounds of bituminous coal for a charge. As these retorts are in benches three deep, close together, and the fires are not slackened when the burning coke is drawn out, the labor of discharging and recharging the retorts is extremely arduous. In fact, in warm weather such work is almost inhuman, and the difficulty of finding labor is great; besides, it is impossible to keep the retorts working to their full capacity. The Bronder charging machine does all this work and does it quicker and better than hand labor. It consists of a carriage propelled and operated by three steam engines, all on the carriage, and all supplied by steam from a series of loops of iron pipes which open and close like the legs of a compass as the carriage moves about on the track. Three pans, one above another, shaped to fit inside the retort, and filled from the hopper on the carriage, are thrust into a retort, previously emptied, then the pans are drawn back, the piston at the end preventing the coal from coming back into the pan. The discharging and charging are accomplished by machine in one and a half minutes and the gas is saved which would otherwise escape during a longer opening of the doors of the retort.



BUCKEYE TRACTION DITCHER AT WORK NEAR PLAINFIELD

DISTRIBUTION OF THE GAS

The problem of the distribution of the product of five and a half billion cubic feet of gas does not present any unusual features in the Northern New Jersey section. Over most of the area the population is as dense as in most cities of the same size. From the Newark plant gas is sent to Summit, a distance of twelve miles, and several other nearer cities also are supplied. Throughout the system the pressure of gas is maintained, so far as possible, at what is known as thirty-tenths; this means that the pressure of gas is sufficient to raise water to a height of three inches in a U tube, one end of which is connected with the main and the other open. As a column of water 27 inches high weighs about one pound, anyone who desires to may readily test and calculate the pressure. An excessive pressure causes gas to escape from a flame without complete combustion—a condition which the wise man may avoid by partly closing the valve at his meter. While this territory offers little that is novel to the investigator, the opposite is true of the South and Central New Jersey field. There a combination and concentration of production and distribution is going on that is analogous to the changes in the North Jersey electrical field. A modern gas plant, with Otto Hoffman ovens, has been constructed at Camden, and from there gas is being distributed over the southern and central territories and the small plants are being closed. Last year a ten-inch main was completed from Camden to Trenton. Gas is forced into this pipe by an Ingersoll-Rand compressor, with a pressure of 20 pounds to the square inch at Camden, which decreases to two pounds at Trenton, where it is delivered to a receiver and distributed at the usual pressure. The residences along the line of the high pressure main, between Camden and Trenton, are supplied by the use of a Johnson-Reynolds Gas Pressure Regulator. An incidental advantage of this system is that during compression the water vapor is forced out, so that dry gas is delivered at Trenton, it being stated that during the past six months not so much as half a barrel of water has been pumped from the whole Trenton distributing system. This year the high pressure supply pipe has been extended from Trenton north, and is nearly completed as far as Plainfield. When it is in operation the gas manufacturing plants at Plainfield and at New Brunswick will be abandoned. The laying of this pipe by the Harrison Construction Co. has been an unusual undertaking. That company has had in use since May, when it began work, two Buckeye Traction Ditchers. Each machine is operated by an engineer and a fireman and has cut on an average 900 feet of 4-foot trench a day, having done as much as 1800 feet in a single day. The character of the soil has been varied. In the neighborhood of New Brunswick the larger of the two machines cut the ditch successfully through shale rock. The pipe laid is 10-inch wrought iron, with screw joints, made by the National Tube Works. When finished it is tested under an air pressure of 50 pounds to the square inch. The main is provided with valves at intervals of one mile. The total length of the line laid this year is 37 miles, and the weight of pipe is about 7,000,000 pounds. Results obtained by

the use of this long line, 67 miles from the plant in Camden to the holder in Plainfield, will determine to what extent the system will be adopted in the future. Altogether there are 1537 miles of mains, through which gas is distributed to about 204,000 consumers.

BUSINESS METHODS IN THE GAS DEPARTMENT

In order to promote the sales of gas, the same liberal system that prevails in the Electrical Department has been adopted by the Gas Sales Department. The effort is made to satisfy all by teaching them how to get the best results out of the quantity of gas consumed. The competition between the two departments works for the interests of the consumer. That this competition is genuine there can be no doubt; in fact, the agents of each department have assured the writer that they "would do" the other department out of a customer every chance they could get. In accordance with the policy of the company to give the customer the most possible for his money, the Gas Department imports from England the five-foot Bray burner, and they are distributed freely among customers. This burner has a check inside so located as to leave a chamber between the check and the outlet, the object being to reduce pressure and secure complete combustion of gas. For use in commercial lighting the company sells at actual cost the gas arc lamp, so called, made of four Welsbach burners. The candle power of this lamp is 250 and it consumes 12 cubic feet an hour. The care of lamps is also assumed and they are kept supplied with mantels at a charge of 25 cents a month. The department throughout the whole district supplies the various municipalities with 8357 public lamps, of which 2673 are Welsbach. Prices vary from \$17 to \$21 a year.

No other corporation, perhaps, has ever attempted to supply so many public utilities to such a number of towns and cities, and the outcome of its ventures will be closely watched by students of municipal affairs. In the electrical field the consolidations and improvements enumerated have, according to the estimate of an electrical engineer, who is a competitor of the big company, given the Public

Service Corporation an advantage of about one cent per kwh. in cost of power at the point of distribution, as compared with the cost of production of a small plant, the latter being figured at 3 cents per kwh. bus-bar cost. Competition and not cost plus interest charges is likely in the long run to fix Public Service prices. For any additional business taken at a price exceeding bare cost of production is an advantage when there is power to spare, and competition will not allow prices to go above cost of production and distribution and interest charges for a small competing plant. In the gas field there is not room for two companies in one town, and no advantage will be derived by the public from the presence of a second company. Hence, in some way or other, by State or municipal agreement, the price of gas will probably be regulated on a reasonable basis and the present company will retain the field. It seems certain that for a long time the Public Service Corporation will be a prominent factor in the affairs of the municipalities of the State of New Jersey.

STREET WORK IN AUGUSTA, GA.

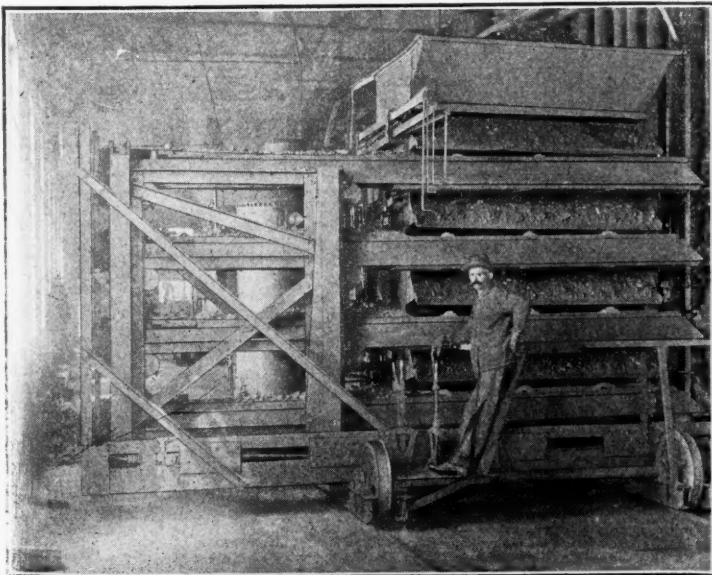
IN 1905 there were removed from 115,284 square yards of paved streets in Augusta 1,161 loads of manure, besides large quantities of leaves. The manure was sold for \$126.56, the leaves for \$12.90. Besides these, the manure from the city stables and Fire Department brought about \$175; all being sold to the highest bidder for the year's collection. It is proposed to use them for fertilizing the city park in the future.

Under the existing law, the city sprinkles any street or portion of a street on request of one-half of the property frontage. The city furnishes the outfit and the property owners pay the actual cost of the work. Last year 11.7 miles were sprinkled at a total cost of \$2,922.80, including \$1,131.62 for salaries and \$1,130.80 for feed and blacksmithing; also including \$318 for mules and other increases in assets. Most of the streets were charged 3.6 cents per lineal foot. The department owns 11 head of stock, 6 sprinklers and sets of double harness, and other property, totaling \$3,642 in value.

The Tree and Park Commission planted along the streets in the spring of 1905, 437 nursery trees, of which 385, or 88.1 per cent., lived. In the fall they planted 200 more, half Norway maples and half pin oaks. In the previous year, when the trees were forest trees from damp soil, only 42.7 per cent. lived.

The street construction work of the year consisted of 6,532 lineal feet of brick gutters; 8,593 feet of wood gutters; 4,247 feet of stone curb at an average cost of about 34 cents; 66 catch basins, costing about \$22 each; 7,850 square yards of brick paving, 443 of Belgian block, 17,839 of macadam, and 16,306 of gravel roads.

Plans are being made for the construction and repair of a large number of thoroughfares, and the prospects are that the coming season will witness the inauguration of a large number of improvements.



THE BRONDER CHARGING MACHINE

STREET LIGHTING IN TWO CITIES

**Boston and Baltimore Compared—Number of Lamps and
Cost per Lamp, Electric, Gas and Gasoline
Variety—Contract Requirements**

At the beginning of this year, Boston had a population of approximately 590,000, and Baltimore one of about 550,000. Each of these cities makes very complete reports on its street lighting, and it is interesting to compare the data relative thereto. Fortunately for this comparison, the requirements of the contracts in the two cities are almost identical, and below, in addition to the data of both cities, are given the provisions of the Baltimore contracts, which are practically the same as Boston, as representative of both.

**Comparative Data Relating to Street Lighting, January 1,
1906.**

	Boston	Baltimore
Number of electric arc lamps in use.....	3,757	1,726
Number of electric arc lamps per 1,000 population.....	6.27	3.14
Number of electric incandescent lamps.....	32	.....
Number of incandescent gas lamps..	9,623	6,663
Number of incandescent gas lamps per 1,000 population.....	16.07	12.11
Number of incandescent naphtha lamps.....	1,943	1,043
Number of incandescent naphtha lamps per 1,000 population.....	3.24	1.90
Gas lamps on fire-alarm signal boxes	171	.....
Triple-mantle gas and double-mantle naphtha lamps.....	87	.....
Total of all lamps.....	15,613	9,432
Total of all lamps per 1,000 population.....	26.06	17.15
Total of all lamps per mile of street..	31.2	24.4
Cost per year of each electric arc light, contract price.....	\$124.10	\$67.49
Cost per year of each incandescent gas lamp, contract price.....	28.80	16.25
Cost per year of each incandescent naphtha lamp, contract price....	29.20	27.50
Total cost of lighting in 1905, electric arc lights.....	\$442,757.41	\$152,718.28
Total cost of lighting in 1905, incandescent gas lights.....	291,012.12	119,163.61
Total cost of lighting in 1905, incandescent naphtha lights.....	59,453.94	25,957.30
Total cost of lighting in 1905, all lights.....	793,223.47	297,839.19
Total cost of lighting in 1905, per capita.....	1.32	0.54
Total cost of lighting in 1905, per mile.....	1,586.47	771.60

The salaries and incidental expenses of the Lamp Department of Boston were \$13,953.43; of the Baltimore Department of Lamps and Lighting, \$13,574.78. The former employs, besides the Superintendent, two clerks, two messengers and two inspectors; the latter, besides the Superintendent, an Assistant Superintendent, seven district superintendents, four inspectors, a clerk and a collector of gas meters.

In Boston, 265 electric arc lamps, furnished by one company, cost \$127.75 each per year; and 312 others, in parks and squares, are connected to underground wires belonging to the city, for each of which the company receives a rebate of \$3.65 a year. Baltimore pays the contractor who furnishes and maintains the gas lamps, \$9 each per year; and pays a gas company \$7.25 per lamp

per year for gas. If we call the actual candlepower of a nominal 2,000 candlepower lamp 700, Boston has 5 1-2 candlepower and Baltimore 3 candlepower per capita; Boston has 6.6 candlepower and Baltimore 4.3 candlepower per mile of street.

During the year there was in Boston a net increase in the number of arc lights of 26, and of incandescent gas of 149; and a decrease in the number of incandescent naphtha lamps of 62. In Baltimore there was a net increase of 128 arc light and 89 incandescent gas; and a net decrease of 104 naphtha lamps. During the year, also, 152 naphtha lamps were discontinued, probably being replaced by gas and electricity in most cases.

The schedule in both cities is every night and all night, not to exceed 4,000 hours annually. In Boston the hours decrease by 15-minute intervals from between 4:30 P. M. and 6 A. M., on January 14th, to between 7:30 P. M. and 3 A. M. on June 4th; continuing at this to July 15th, after which it increases to between 4:30 P. M. and 6 A. M. on December 24th; a total of 3,828 hours yearly. The outages in Boston in 1905 were 2,792 electric arc, 2,344 gas and 1,501 naphtha.

While the rate paid in Boston for electric arc lamps was \$124.10, the price is fixed according to sliding scales. The Edison Company's schedule is \$127.75 for any number between 2,365 and 2,749 lamps, and decreases by \$1.82 at a time for each increase in number of 250; being \$109.50 for 5,000 and over. The Brookline Company's schedule is the same, except that the numbers of lamps range from 250 to 900 and over.

The requirements of the Baltimore contracts are as follows:

ELECTRIC ARC LAMPS

All labor, apparatus, lamp posts, mast arms, brackets, cables, wires, conductors, arc lamps, fixtures, fittings, connections, carbons, globes and appurtenances of any and every description necessary for the lighting of the streets, etc., by electricity, under the requirements of these specifications shall be furnished by and at the expense of the contractor, as also for all electric current and labor of every description for supplying all arc lamps with electricity and for maintenance and repairs of every kind. All construction, supplying of current, carbons, globes, lighting, extinguishing and keeping in repair and labor shall be done at the expense of the contractor.

Precautions shall be taken against accident and the city indemnified against damage suits. Lamps in the district where there are city conduits shall be served from cables carried in these conduits, which cables may be purchased by the city at the expiration of the conduit; a duct rental being meantime paid to the city by the contractor.

The arc lamps provided under these specifications are to be of any standard and approved type, and to operate on continuous current of not less than six and six-tenths (6.6) amperes and at a pressure of not less than seventy-two (72) volts, measured at the arc for inclosed arc lamps sufficient to produce what is known as a nominal 2,000-candlepower light; or to operate an alternating current of not less than seven and five-tenths (7.5) amperes and at a pressure of not less than seventy (70) volts, measured at the arc for alternating current arc lamps, sufficient to produce what is known as a nominal 2,000-candlepower light, which must be maintained uniformly at each and every arc lamp in each and every circuit under this contract. Each alternating current arc lamp must be provided with an approved reflector.

Every arc lamp shall be supplied with one-half (1/2) inch carbons of best quality and with globes of clear glass of uniform thickness and proper shape, to avoid causing rings or streaks of light and shadow. All globes that may become broken must be replaced by sound ones each day before starting the lights, and all electric lamps used under this contract shall burn with a clear, steady white light, without undue hissing or flickering, each and every night during the term of this contract.

The locations of lamps must be changed on request from the city, which will pay for the labor involved. All lamp posts and fixtures must be given two coats of paint once a year or oftener, if necessary, and must be kept plumb; all lamps must be adjusted to distribute light to the best advantage.

The Superintendent of Lamps and Lighting shall have the right to require the contractor to furnish a vertical half-ground globe for the purpose of shading such house or houses as may be deemed advisable in the judgment of the Superintendent of Lamps and Lighting, which the contractor shall furnish without any additional cost.

In case of open arc lamps, dirt and carbon dust must be removed from the globe and thoroughly cleansed inside and outside each day before starting to light. In the case of inclosed arc lamps this must be done as often as necessary. Each inclosed arc lamp shall be supplied with a clear glass, or opalescent glass, under globe, as may be directed by the Superintendent of Lamps and Lighting, and shall also be supplied with a clean glass outer globe.

The Boston lamps are enclosed series arc lamps of 500 watts; more than 90 per cent. are direct current.

INCANDESCENT GAS LAMPS

This contract includes the furnishing by the contractor of incandescent mantle burners, mantles, automatic regulators (if found necessary), street signs, globes and all other necessary fixtures, parts, appliances and supplies used for incandescent street lighting, except lamp posts, which will be furnished by the city, for all the gas lamps now in service in the public streets, avenues, lanes, alleys, parks and squares and on the bridges within the City of Baltimore, and for such additional gas lamps as may be ordered to be installed by the Superintendent of Lamps and Lighting. All of said lamp fixtures must be attached to all city lamps by the contractor in an open manner so as to produce a light not less than sixty (60) candlepower at all times during the hours of burning. The contractor must estimate to keep all of said incandescent lamp fixtures in thorough repair, replace all broken and cracked globes and parts and all broken or defective mantles at all times when found necessary, during the term of the contract.

The contractor to furnish all the incandescent lamp fixtures for the present "Miner" lanterns; also "Boulevard" lanterns to be used in place of the "Miner" lanterns now in service, and to be attached to the lamp posts in the public parks and squares by the contractor; also to furnish lanterns and globes for lamps in groups and clusters, similar in design to those now in service on the city bridges and in the squares, or of some other artistic design to be approved by the Superintendent of Lamps and Lighting, and to be attached to the lamp posts on the city bridges and in the squares by the contractor. The city to furnish the supply of gas at the burner, and the bidder must estimate to furnish the labor to light, extinguish, clean the globes, maintain and operate the lamps and keep the lamps in thorough repair.

The candlepower of each gas lamp with the use of an incandescent mantle burner and fixtures must produce a light not less than sixty (60) candlepower, and each incandescent mantle burner and mantle must produce a clear, bright light, without undue flickering or smoking.

Each incandescent mantle burner must be kept clear at all times so as to allow a free and unobstructed flow of gas, and must be adjusted and regulated, by the use of automatic regulators or governors, so as to produce a light equal in power to sixty (60) candles, under varying pressures of gas above two inches, during the hours of burning. The needles or valves used to regulate the supply of gas, the shutters or governors used to regulate the supply of air, the tubes and all other attachments of the burners must be kept free from rust and corrosion so as to permit of being easily adjusted or regulated when found necessary to increase or diminish the pressure of gas and the supply of air, as conditions may demand from time to time, to insure a perfect Bunsen and to maintain the standard of light required at all times during each night.

The gauze wire tips shall be kept perfectly clean and shall be replaced with new ones whenever the gauze wire tips shall become corroded. The lamp shall be so adjusted as to secure a light of not less than sixty (60) candlepower, and to consume from two and one-half (2½) to three (3) cubic feet of gas per hour.

THE GAS CONTRACT

The contractor furnishes gas for all street gas lamps at \$7.25 per lamp per year, each lamp not to exceed 4,000 burning hours a year, nor burn more than 2½ cubic feet of gas in any one hour. To determine the consumption, three meter lamps are installed on each of the lamplighters' routes, so arranged as to be the first, center and last lamp on the route, the average of which shall be considered the consumption of all the lamps. The gas is to be furnished at the burner; but the city pays \$5 for connecting up each new light. The contractor maintains all mains and service pipes. The gas standard required is 20 candles, rated at 5 cubic feet per hour, compared with a standard sperm candle (six to the pound), burning 120 grains of spermacetti to the hour. During the year the highest monthly average candle power was 24.40, the lowest 20.91, and the average 22.70.

INCANDESCENT NAPHTHA LAMPS

The contractor will be required to furnish all iron lamp posts, lamps, or lanterns (either globe type or square frame), incandescent mantle burners, incandescent mantles, globes, glass street signs and all other fixtures for maintaining and operating the incandescent mantle gasoline or naphtha street or outdoor lamps; also all the gasoline or naphtha which may be necessary to supply all the lamps. The gasoline or naphtha must be of the very best grade and of a gravity not less than 72°, free from water, gum, glue or other impurities. Each lamp must produce a light not less than sixty (60) candlepower, and each incandescent mantle burner and mantle must produce a clear, bright light, without undue flickering or smoking.

Pittsburg's Atmosphere

PITTSBURG, PA., has sometimes been suspected of rather taking a pride in her appellation of "Smoky City," but it has been brought home to her in a new fashion that her atmosphere is objectionable to some persons. The United States Naval Recruiting station there is being abandoned because the smoke and cinders so affect the inhabitants' eyes as to prevent their being considered suitable for the service.

WATER FOR FIRE FIGHTING

SEVERAL articles have appeared in the technical press recently concerning the relatively small amounts of water required for fire fighting. One of the largest fires which has occurred in Boston, Mass., in recent years, for instance, is stated by Chief Engineer of Water Works F. P. Stearns to have required but 2,150,000 gallons, the maximum rate being about 10,000 gallons a minute when twenty-one engines were in service; the longest time for an engine was 17 1-3 hours.

Most of the figures given have been for large cities. The quantities required for similar use by the fire departments of smaller cities may, however, be estimated as follows: An assumed head of 200 feet at the hydrant, 300 feet of hose to a line, and 1¼-inch nozzles, will give a discharge per nozzle of 270 gallons a minute, which is more than the average for any section of the country. The table gives, for several populations between 1,000 and 200,000, the maximum numbers of fire streams to be provided for according to Freeman, who is probably our best authority on the subject; also the numbers of gallons per hour required to furnish these on the basis of the above assumptions. For most cities this is 10 to 25 per cent. too large.

Population.	Number of Fire Streams.	Gallons Per Hour.
1,000	3	48,600
3,000	5	81,000
5,000	8	129,600
10,000	12	194,400
20,000	15	243,000
40,000	18	291,600
50,000	20	324,000
60,000	22	356,400
100,000	30	486,000
150,000	36	583,200
180,000	40	648,000
200,000	50	810,000

This last is 35 per cent. greater than the maximum rate given for the fire in Boston, which has nearly 600,000 population; which, in turn, was larger than the figures generally given for the Borough of Manhattan, New York. The number of fire streams required was estimated by Mr. Freeman as those desired for the best possible protection, and it is probable that the figures for the larger cities are actually obtained in few if any cases. The quantities in the table are therefore the maximum which are likely ever to be demanded. It will be noticed that they are approximately 50,000 times the square root of the number of thousands of population. It is seldom, however, that the amount required would exceed 50,000 times the cube root of that number. The writer believes that 200 gallons per capita is the maximum total amount which could be used on the most prolonged conflagration. This is equivalent to four or five hours in a town of 1,000 population, to twenty-two hours in a city of 30,000, and fifty hours in a city of 200,000. He knows of no fire which has lasted longer than this. This duration of a fierce conflagration would destroy practically the entire place, or at least that area of it where were available the number of hydrants called for by the above table. One deduction from the above is that water storage should never be allowed to become less than 200 gallons per capita over and above that needed for ordinary consumption. This would be amply safe, for it would be a most exceptional fire which would use more than 100 gallons per capita; it is seldom, in fact, that this amount is reached by the total fire consumption of an entire year.

CIVIC CENTERS AND PUBLIC BUILDINGS

Widespread Demand for Grouping of Government Edifices in Municipalities of America and Other Countries — Progress of Movement Since Egyptian, Greek, and Roman Times—Work of Art Commissions

By STEPHEN CHILD, Boston, Mass.
Landscape Architect and Consulting Engineer

THERE are on every hand cheering forecasts that a brighter day is dawning upon our American city life, that the fierceness of the rush and drive of the commercial whirlwind through which as a nation we have been passing is somewhat abating, and though black and angry clouds lower upon the horizon they are being broken up and dispersed by the bright sunshine of a more rational, a more peaceful, and a more wholesome life, a life in which a more brotherly and neighborly feeling is growing, and in which all uplifting, moral and esthetic influences are having better opportunities for growth and development. While nothing can permanently darken or defer this brighter day to which we look forward, we may, by ill-considered and selfish actions, retard its progress. On the other hand, there are many influences over which we have direct control which may greatly hasten its arrival. Perhaps not the least helpful of these beneficent influences is the comparatively recent movement for a better civic art, better buildings both public and private, more numerous open spaces, adorned not only with flowers, shrubs and trees, but more frequently with fountains and other objects of art, such as properly located statuary, designed in an appropriate and dignified manner. The uplifting and inspiring influence of such artistic surroundings upon the community is very great, and they should be still further increased.

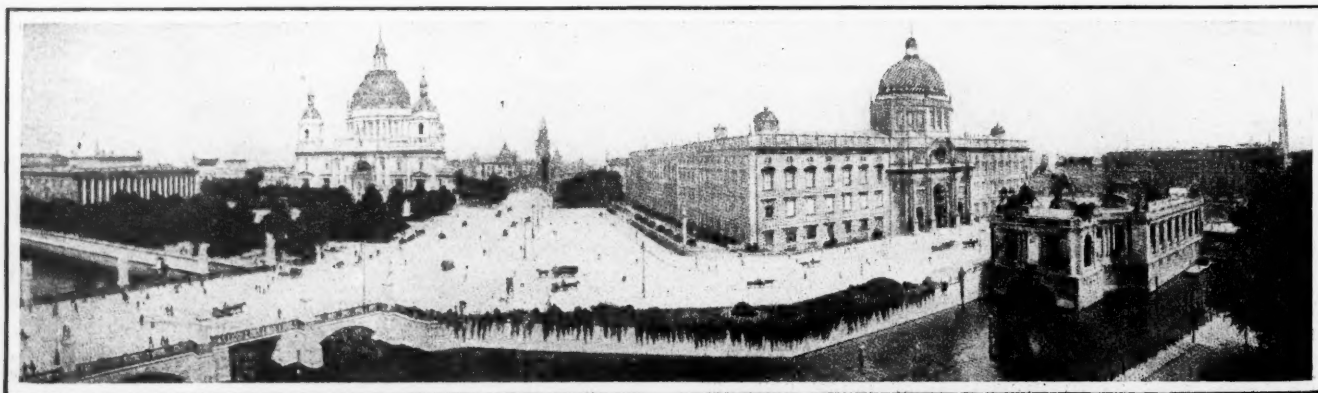
Much of the trend of civic improvement of late has been outward in ever increasing circles, due largely to the wonderful development during the past twenty years in improved methods of rapid transit. Fearing that in this rapid growth our cities would be deprived of all their beauty spots, we have been making great efforts and expending great sums of money to secure and develop large rural parks and scenic reservations, and to provide suitable parkway and boulevard approaches and connecting links for these great systems. Far be it from me to

decry the value of all this. On the contrary, I think most thoughtful people believe fully in the foresight and good judgment our Park Commissioners have shown in securing and developing these most delightful features of modern city life, and that as time goes on it will be shown that they have proved of inestimable value to the health and morals of our great municipalities. Such features add to their fame, and tend to attract not only visitors but permanent residents of great value.

GROUPING OF BUILDINGS

Possibly, however, some few of our Eastern cities have gone far enough in this direction for a time at least, and it may well be that a bit of introspection will do good. May it not be that we need to study and reorganize the plan of the older and more thickly settled portions of such cities, with a view to securing more open spaces, and wider and more direct means of communication in their crowded portions? Certainly in this study, the grouping of needed public and semi-public buildings into so-called civic centers should be carefully considered.

The demand for a finer expression of civic art, especially in connection with our public buildings, is immediately confronted by the loss in dignity due to their widely separated locations, and it is becoming more and more evident that if such buildings can be grouped about a plaza or along a wide mall-like avenue in such a way that each building takes its proper place in harmonious architectural relation with other members of the group each is enhanced in dignity and value. The assertion by a prominent architect, that "isolated buildings of whatever individual merit are insignificant in comparison to massed constructions, even if these latter be comparatively mediocre in quality," can hardly be gainsaid. It is evident that really fine buildings may be robbed of much of their impressiveness by being poorly located, crowded in among



A CIVIC CENTER AT BERLIN

sky-scrapers, or more inferior buildings, in such a way as to give little opportunity of seeing them and almost no chance to appreciate their beauty.

If beautiful buildings could only be grouped about a square or suitably proportioned open space, how much more would they be admired and appreciated, and what a welcome addition would be made to our civic pride, now for many reasons almost extinct. I believe a finer spirit would be aroused, and who shall say that as a result of this sort of publicity there might not be less corruption and so-called "graft" that now has such a good opportunity to flourish in our secluded and ill-placed public buildings. Nobody cares to go near them, and they are frequently either so ugly or so inaccessible that many an intelligent, progressive citizen scarcely knows where they are and never visits them, unless it is absolutely necessary. Whereas, if they were attractive and well placed they would be more frequently inspected, and the "grafter" would feel that he was being more carefully watched than at present. Then, too, there is the great utilitarian gain in convenience if public buildings are grouped thus into administrative or civic centers, and a valuable saving in time for those having to transact public business by having them so massed.

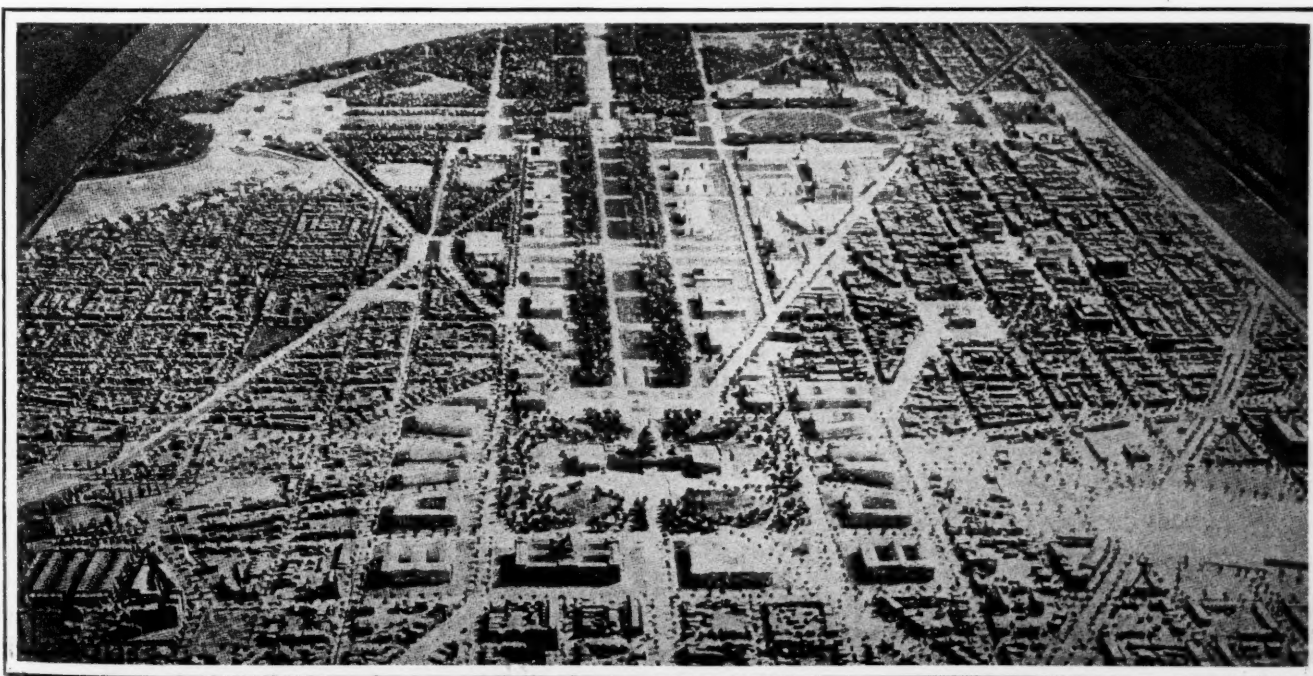
PROGRESS OF THE MOVEMENT

It may be interesting and profitable to study briefly what has been done in these respects in some European and American cities. The movement in this direction embraces most of the progressive municipalities of the civilized world, and, profiting by some of the mistakes of the older European cities, we here in America have been able to prepare plans, some of which are now in process of execution, which are distinct improvements over anything heretofore executed, except those, perhaps, at Paris and Vienna, and will make some of our American cities notable in this respect.

While the movement toward securing civic centers and properly grouped public buildings is now receiving such well-deserved attention, and is sometimes spoken of as a new movement in civic life, it might more properly be referred to as a renaissance, for early historical research in the architectural development of cities shows us that such matters were very carefully considered in ancient times. Many of the celebrated early Egyptian communities show examples of this grouping, and in some instances the open spaces were embellished, as we know, with obelisks and other monuments. In some of these squares or plazas the shadow of the obelisk in the center marked the passing hours upon the pavement, a suggestion worthy of our notice in the present day.

In Assyria and Persia there are evidences that the grouping of palaces and temples was considered in very early times. But while we have some knowledge of these matters, the result of painstaking efforts of archaeological students in Egyptian and Assyrian art, perhaps the most noted and certainly the most impressively dignified civic center of antiquity was the Acropolis at Athens. Here each building was nobly planned, not for itself alone, but in its relation to others of the group. Even the ruins that have come down to us are magnificent. How much more so must have been the spectacle presented in the days of Pericles when every column was intact, every pediment and statue stood perfect and unmarred.

The Greek genius was essentially and peculiarly artistic, that of Rome more especially political and administrative in its character. Rome conquered and administered and civilized the world of its time, founded modern civilization, in fact, and while perhaps not creating a new art, developed and enriched other arts. The city of Rome became the center of all this administrative genius, and here about its Forum was built another grand civic center entirely different from that at Athens, but in its way equally impressive.



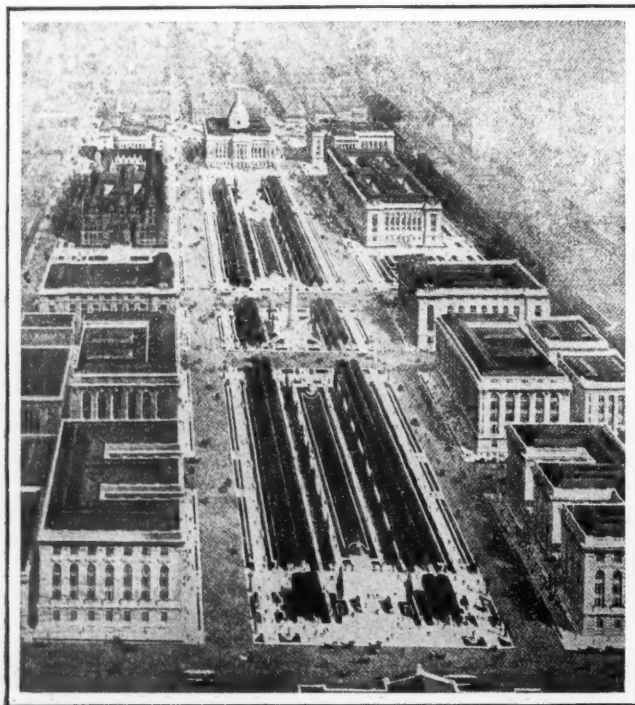
PLAN PROPOSED FOR GROUPING PUBLIC BUILDINGS AT THE NATIONAL CAPITAL

Both the Acropolis at Athens and the Roman Forum afforded the people of these cities opportunity to mingle together, sharing their thoughts, their joys, and their griefs; here matters of the common weal were discussed and a broader public spirit which is felt even in these days was developed.

EFFECT OF THE DARK AGES

After the decline of Greek and Roman influence and during the so-called Dark Ages little thought was given to any of these matters. Medieval cities were closely crowded communities, usually surrounded by fortified walls for the protection of the people from the attacks of wandering bands and neighboring feudal barons. Civic conditions were anything but attractive in these times. Streets were mere lanes, neither paved nor sewered. There were in most of these towns market-places, however, and, thanks to this provision, such communities now possess an open square, which has in more recent times been cleared of its booths and wagons and embellished with planting, fountains and statuary, often making of it a most impressive and beautiful feature of the town's life. This development of the market-place has, however, come as a much later step. In medieval times these places were not cared for or improved, and there was no particular effort to group about them important public buildings, although the town-house and a church may have been built facing them.

As warrings ceased and more peaceful times appeared the towns and cities of Europe began to overflow the confines of their fortified walls and to spread out into the surrounding country. The space occupied by these walls or bulwarks was later seized upon and utilized for great public improvements, for boulevards and civic centers in Paris and other cities. In Vienna such space was developed into the magnificent Ringstrasse, so called.



PROPOSED CIVIC CENTER AT ST. LOUIS, MO.

PARIS, VIENNA AND BERLIN

In no city in the world, perhaps, have better results been secured in this matter of the proper placing of buildings than in Paris. Among the many notably beautiful civic centers and impressive groups of buildings here may be mentioned the Louvre and Tuileries Gardens, The Place de la Concorde, The Trocadero and Gardens, The Place de l'Étoile and its Arc de Triumph, and literally scores of others which are familiar to all visitors at the French capital.

The whole subject of civic art in Paris is placed in the hands of experts, and with the tireless energy of the French nation no such thought as standing still is ever considered. Progress toward better things is continuous. Every year sees plans for civic improvements made, which perhaps may be years in their execution, but which are all carefully studied, and, when the need arises, are ready for execution. In this way, few mistakes are made.

Next to Paris, and, in fact, vying with it, if not in some respects excelling it in the grandeur of its civic improvements, is Vienna. Here the great space occupied by fortresses with their inclosing walls and the open spaces formerly reserved for military drill grounds, becoming, as they did about the middle of the past century, not only of no avail for the original purposes for which they had been occupied, but a hindrance to the growth and development of the city, were, through the farsighted and progressive good judgment of Emperor Francis Joseph, converted to the nobler purposes of magnificent civic improvements. A portion of this tract that had been occupied by the old city wall was converted into a beautiful, broad, tree-lined boulevard, or Ringstrasse, so-called; another portion was developed into parks just off from this boulevard, and forming magnificent foregrounds and settings for needed public buildings. The area to be utilized was so great that still another portion of it could be reserved, and, under careful restrictions, sold to furnish funds for building magnificent buildings and providing for their embellishment with suitable statuary and other effects.

What is particularly to be remembered is that the splendid results to be seen here have not been due to chance, but have been brought about through the execution of most carefully thought out plans, made with remarkable foresight some fifty years ago, and adhered to with a steadfastness of purpose greatly to the credit of the people of the Austrian capital. Would that some such steadfastness might inspire the law-makers of our own nation at Washington to adhere to and gradually and consistently carry out the magnificent scheme for civic improvement first planned by L'Enfant, Washington and Jefferson, over one hundred years ago, and now so happily revived and forming the inspiration for the plans of the so-called Burnham Commission.

Next in importance to Paris and Vienna comes Berlin. Here the entire Spree Island has been devoted to public buildings, properly placed amidst carefully designed open spaces. Extending westerly for over two miles and a half, the famous "Unter den Linden," literally lined with impressive buildings, leads to the Brandenburg Gate and the

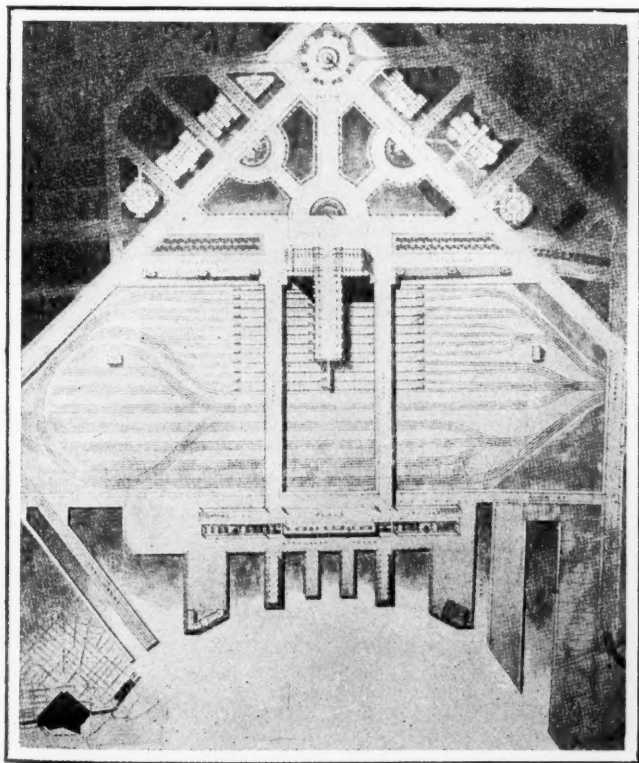
Thiergarten. There is no more famous avenue in Europe, and it is a civic center of great impressiveness.

Space will not allow for more than allusion to the many other evidences of careful and successfully beautiful examples of the grouping of public buildings in other great cities of Europe. There is the Royal Palace and Square at Madrid; St. Mark's Square, Venice; Trafalgar Square, London; not to mention strikingly beautiful examples at Brussels, Dresden and Cologne, and many other of the large and not a few of the small cities.

PROBLEM IN AMERICA

Turning, now, from European examples, let us see what awakening America is doing in these respects. We have space to merely enumerate a few of the more important of our progressive cities that are seriously studying these problems, but this list and the illustrations will give a slight idea of the extent which the movement has attained. Perhaps no one event has greater influence upon the question than the World's Fair at Chicago in 1893. Inspired by its impressive Court of Honor, and more or less influenced by the master minds that designed it, one after another of our cities is at work upon plans for groups of public buildings. Most notable of these may be mentioned Washington, D. C., Cleveland, O., St. Louis, Mo., Minneapolis, Minn., Buffalo, N. Y., Philadelphia, Pa., New York City (Manhattan and Brooklyn), San Francisco, Cal., Hartford, Conn., Springfield, Mass., Providence, R. I., Denver, Col., Columbia, S. C., and even far away Manila, in the Philippines, and Honolulu, Hawaiian Islands. At all of these places carefully prepared plans have been submitted and more or less completely adopted.

It is evident that the movement in this direction is a



PROPOSED CIVIC CENTER AT BUFFALO, N. Y.

broad and inspiring one, and needs only to be well directed to bring forth grand results for our prosperous American cities. No city should enter upon an improvement of this sort without having had the whole matter carefully studied, under the direction of a broad-minded Civic Improvement Commission, composed in part at least of experts, or at least employing one in an advisory capacity. This careful study made, and plans developed, the whole tract of land needed may perhaps be condemned first and held by the city, and its gradual development along the previously well considered lines proceeded with later as the resources of the municipality permit.

An important point in this connection would appear to be the securing not only of the land to be specifically occupied by the desired new buildings and their approaches, but the immediately adjacent land as well, so that the entire community may benefit by the increased value resulting from these improvements. This is the method employed in several European cities, and there is no doubt that if carefully safeguarded it may be the means of ultimately saving to the city large sums of money, besides enabling it to control the architectural features of the quasi-public and other buildings which might be here built, and thereby greatly increase the esthetic appearance of the entire project.

DISPLAY LIGHTING IN BERLIN

THE regulation of artificial lighting in connection with window displays, is a subject which has been given comparatively little attention by the municipalities of this country, considering the extent to which it is used for this purpose in these days. That this phase of the lighting question demands closer scrutiny there can be no doubt, and it might be well for information on the matter to look to those cities which have given it study. Stringent regulations have been adopted in Berlin and other European cities, where merchants were inclined to take advantage of laxity in the premises. In Berlin lamps outside shop windows must not be lower than ten feet above the pavement, nor project more than forty inches from the wall. Where the lighting in the windows is done by oil, petroleum, gas flame or Welsbachs, there must always be a sheet of glass not less than one-tenth of an inch thick under the lamps and running the whole length and breadth of the shop window, so as to completely cover the articles in the window; and nothing is to be put above the lamps. The lamps must be at least forty inches below any inflammable part of the construction and ten inches from any such part horizontally.

There are also regulations as to iron screens where there is bare wood, and as to efficient ventilation. Bare flames are not allowed in igniting the gas. This must be done by chemical or electrical kindlers, or by electric distance spark-kindling arrangements especially sanctioned by the authorities. The regulations for incandescent electric lamps are about equally strict.

NOTES ON STREET LIGHTING

Adequate Service Often a Difficult Problem—Distribution and Needs of Population—The Electric Arc—Gas and Incandescent Lamps

By J. I. MANGE,

Manager Watertown Light and Power Co., Watertown, N. Y.*

A SPECIAL and very important department of lighting has to do with streets and other outdoor spaces. It involves not a few unusual difficulties, for there is unlimited space to deal with as well as an indefinite variety of natural and artificial obstructions, and, save in narrow streets bordered by high buildings, one gains little or nothing from the diffusion that is so important a factor in interior lighting; and in many instances the streets are so thickly shaded by trees that the problem of adequate lighting is very difficult, and one for which local data are necessary for its solution, if it is to be done properly. The amount and distribution of streets and the needs and distribution of the population are the controlling factors in the matter and obviously these vary greatly from place to place.

It is interesting to note that it is now about twenty-five years since the electric arc was first applied to street lighting, and it has proven itself to be really the only source of light profitable to consider.

The incandescent lamp is by no means to be thought unfit for service, as many of them are now doing admirable work in small towns, in suburbs of cities and in many blind alleys and courts where the expense of an arc lamp is unnecessary. However, at the same total cost, the arc lamp gives a considerably higher average illumination and experience shows that on the whole arcs which have to be inspected at frequent intervals for the purpose of trimming are kept nearer their point of maximum efficiency than incandescents.

INCANDESCENT LAMPS

In streets where shade trees hang very low and the foliage is very heavy, arc lamps are at a great disadvantage. Here, as well as in many other places where there is no real need of a brilliant light, the incandescent is capable of doing good service at a moderate cost. Economy also sometimes dictates caution in the expenditure for street lighting, and in most cases recourse can be had to the incandescent.

The incandescent lamp is usually fifty, seventy-five or one hundred candlepower when operated in series with the arc lamps, and sixteen, twenty-five or thirty-two candlepower when worked in series upon an alternating current circuit of one thousand or two thousand volts, taking two or four amperes. It should be noted, however, that lamps so operated are costly in the matter of renewals and difficult to operate satisfactorily.

In view of the rapid deterioration of the brilliancy of the incandescent, it is not wise to space them over one hundred and twenty feet apart for good service; although in heavily shaded streets if one hundred candlepower lamps are used and placed on alternate sides of the street, the space between consecutive lights may be three hundred

feet and still produce a fairly well lighted thoroughfare.

This makes the first cost of installation rather high, and therefore the cost per year to the city is higher, relatively, than the arc lamp. For a fifty candlepower lamp the average price is twenty-five to thirty dollars per year.

GAS LAMPS

Gas lamps have been used with considerable success much in the same manner as incandescent electric lamps are used. The old-style open-flame lamp was a very wasteful one, burning eight or twelve cubic feet of gas per hour with little illumination.

With the advent of the incandescent mantle burner, such as sold by the American Gas Light Company, of New York, gas lamps became quite popular and are used now to some extent. These lamps are economical, burning only three and one-half to four cubic feet per hour. The average price for such service is about thirty dollars per year. They are, however, open to the objection that they must be individually lighted and extinguished. The rapid shrinking of the mantles with a diminution of candlepower is another bad feature.

Gasoline lamps with individual tanks have been put on the market, but to the writer's knowledge no success has been attained.

ARC LAMPS

For about ten years the only available arc lamp was the open full arc of two thousand nominal candlepower. These lamps operated at a high amperage, approximately ten amperes, with a low arc voltage, producing a powerful white glaring light near the lamp, and when fitted with clear globes offered a method of illumination which impressed and satisfied the general public, who became accustomed to it and thought the more glaring the light, the better the lamp and system; while in fact the glare is the most serious objection to the open arc, because of the fact that in the presence of lights of great brilliancy the eye contracts and does not recover promptly enough in passing beyond the glare to get the full value of the relatively feeble light at a distance from the lamp.

There are many other objections to the open arc, one of which is the heavy shadow it casts, due to the fact that the lamp burns with a very short arc, the upper carbon in the form of a crater and the lower carbon to a point which intercepts the light emitted by the crater of the upper carbon. The heavy side rods necessary cause excessive shadows in two directions. The arc travels around the carbon quite rapidly and, being open, is affected seriously by wind and weather, causing a very unsteady and flickering arc and an uneven and poor diffusion of light. These lamps have to be visited each day for trimming, which is a large expense that is directly borne by the municipality.

To meet the demand for cheaper light the "Half Arc" of twelve hundred nominal candlepower was introduced. This, however, had the same objectionable features as the full arc, except the glare in the vicinity of the pole was less aggravating.

INCLOSED ARC

The inclosed arc lamp is by far superior to the open arc. In it we have a long arc burning in an inclosed globe

*Paper read before the American Society of Municipal Improvements.

in which the air is practically free from oxygen. Although most of the light comes from the crater, still a greater percentage is emitted directly by the arc itself, owing to its length.

A large portion of the crater's area is visible over a wider vertical angle and the crater is not so concave as in the open arc; hence less concentration and better distribution of light. The principal variation in the light of an inclosed lamp is caused by the travel of the arc over the flat carbon ends.

This variation can be greatly reduced by the use of an opal inclosing globe, which becomes luminous all over and obliterates the shadows which would otherwise be cast by the side rods and lower carbons. Even if we used a clear inclosing globe, the shadows are not so strong in contrast as those of the open arc.

There are two classes of inclosed arc lamps: the direct current and the alternating current. When consuming approximately the same watts at the arc the direct-current lamp gives slightly more light than the alternating current both at the lamp and at the light-intersecting point. The difference, however, is slight and is made up by the better distribution of light to be obtained from the alternating-current lamps.

It seems to me that the arguments to be found against the open-arc lamp are so strong that it is practically eliminated from consideration by any municipality.

While the direct-current inclosed arc lamp emits as much light when consuming the same energy as an alternating-current lamp, it requires special generating apparatus, which is more expensive than the static apparatus necessary for alternating-current lamps, and there seems to be little excuse for the installation of such a system at the present day.

Alternating-current arc lamps may be had that consume any amount of energy from two hundred eighty-five watts to four hundred eighty-five watts. The lamp chosen will determine the number necessary in a given distance to light properly.

DISTRIBUTION OF LIGHTS

The number of lamps per mile is governed, to a great extent, by established location, distance between cross streets, length of blocks, and other local conditions. Nevertheless, the greater economy and superior illuminating value of small units is well worthy of consideration.

While with a constant arc voltage the candlepower of an arc lamp increases in proportion somewhat more rapidly than the watts, the lighting distance increases only as the square root of the candlepower. It is therefore more economical to work with the lower efficiency arc at a short distance than with the higher efficiency arc at a long distance.

There are four standard units of the alternating-current inclosed lamp, viz., 485 (7.5 amperes), 425 (6.6 amperes), 350 (5.4 amperes) and 285 (4.4 amperes) watts per lamp. The distance to which these units will project a given illumination is 247, 227, 197 and 178 feet, respectively, with a corresponding watt consumption per mile of 5,180, 4,940, 4,690 and 4,235, thus showing in favor of the 4.4

ampere lamp, a saving of 945 watts per mile over the 7.5 ampere lamp for the same illumination midway between lamps and with the additional advantage of confining their more brightly illuminated areas along the street.

By maintaining 5,180 watts we can run slightly over eighteen 285 watt lamps per mile; but while the small unit will light a greater distance per watt, the advantage is somewhat offset by the increased initial cost and maintenance per mile for the additional small units required.

LUMINOUS ARC LAMPS

There has been developed in the last year a lamp that is a wonderful improvement over all type of lamps; it is the luminous arc lamp made by the General Electric Company. It is a direct-current lamp of four amperes operated by either the Brush machine or Rectifier Tubes. This lamp operates with about three hundred to three hundred and twenty watts at the terminals and gives an effective illumination of about 30 per cent. greater than the inclosed arc, either series, direct or series-alternating. Tests have shown that the direct-current arc with 480 watts at the terminals gives a certain illumination at 257 feet, the series-alternating inclosed arc with the same energy gives the same illumination at 247 feet, while the luminous arc gives the same intensity at a distance of 325 feet. It is absolutely steady and casts no shadow. It has a life of 180 hours as against 80 hours for the other lamps and requires only one electrode at each trimming.

Many cities which are installing new systems have chosen the luminous arc lamps and the writer is installing them in Watertown, N. Y.

GLOBES FOR INCLOSED ARCS

The choice of globes for the inclosed arc lamps is a matter of some importance. Tests show that the opal inclosing and clear outer globe is a combination that gives the best results, the explanation being that the strongest light throws from the arc at an angle of 35 to 40 degrees below the horizontal, while it brilliantly illuminates the lower portion of the globe which diffuses the light upwardly and compensates for the loss by absorption through the useful angles.

A 6.6 ampere series-alternating lamp has, under test, projected light through various combinations of globes as follows: Opal inclosing and clear outer, 227 feet; clear inclosing and clear outer, 207.9 feet; clear inclosing and opal outer, 192.4 feet; opal inclosing and opal outer, 188.5 feet.

To advise in the abstract concerning the hanging of arc lamps is almost impossible, as local conditions practically force the use of one or the other of the various ways. Most arms and cross suspension are generally used where the wires are overhead.

Pole top fixtures are used occasionally in public squares, but are not very desirable where any other form of support can be used.

Where the system is underground, ornamental poles are desirable. The distance above the ground arc lamps should be hung must be determined for each individual lamp. For open arcs the distance should be about thirty feet; for series direct-current inclosed lamps, twenty-two

feet; for series-alternating inclosed lamps, eighteen to twenty feet; for the luminous arc, about thirty feet. However, in heavily shaded streets it has been found desirable to hang lamps as low as twelve feet from the ground.

Contracts for arc lighting should never be drawn on the basis of a nominal candlepower. They should clearly specify the kind of arc to be installed, the amount of energy to be taken in each arc and the kind of shades to be used. The nature of the fixture should be specifically designated, whether pole top, brackets, mast-arms, or cross suspension, as well as the height above the street each lamp should be hung. These, and the location of the lamps, should be designated by some one familiar with the practical street lighting with due consideration for each peculiar local condition. The hours of lighting should be distinctly stated, with rebates for failure to provide continuous light within these hours. Such rebates should be merely nominal for deficiencies up to one or two per cent. of the total hours of lighting and punitive on an increasing scale for greater deficiencies. With all these things definitely stated in the contract and carried out by the contractor there only remains to deliver to each lamp the requisite quantity of current to insure good street lighting.

FIREPROOF CONSTRUCTION

The Theory of Protection and Prevention—Annual Cost and Insurance—San Francisco's Disaster—Good Building Urged.

By F. W. FITZPATRICK,
Secretary Building Commissioners, Washington, D.C.

MUNICIPALLY considered, when the question of "fire" comes up, one's mind reverts to water, fire apparatus and acrobatic men. Cities vie with one another, not in how few fires they can have, but in how quickly and well the majority of their fires are extinguished. This competition has become keen, to a certain extent it is a fad, and its cost is enormous. In salaries alone to Fire Departments we pay out \$136,000,000 a year; high pressure water and apparatus brings the cost of our so-called "fire protection" to a total of nearly \$300,000,000 a year.

In most of our cities the departments have attained such a degree of efficiency that instead of paying more attention to building properly, people give less, and, indirectly, there is really a premium offered upon poor construction. In San Francisco, for instance, the insurance companies made a very low rate, in spite of the fact that the city was ridiculously wooden and the fire hazard very great, simply because the Fire Department was so excellent. Yet how much did it avail? Think of the accidents, even barring earthquakes, that may happen in other cities resulting in equally great disaster.

Our folly has led us into such a muddle that it will take generations, with even the best of building-laws, to lessen the danger into which we have so fatuously placed ourselves. Think of it, the country over, there

are probably 11,500,000 buildings. Of these, there are probably not 4,000 that are even moderately fireproof in so far as their skeleton, their structure, is concerned, and not twenty that are absolutely fireproof to the extent of not being damageable by fire. Of the millions of our homes, there are not 200 that would withstand a lively fire attack for even five minutes.

FIREPROOF BUILDING EXPENSIVE

To build well, of thorough fireproof construction, costs initially at least ten per cent. more than what is called ordinary building. But the repairs are fewer, little or no insurance need be carried, the returns on the investment are greater and inside of five years' time the owner has actually saved money, and from that time on the difference in profit on the two investments, the good way and the bad way, is growing immeasurably greater in favor of the former. That is, as far as the individual is concerned. Now, as a community, the profit and advantage of sound building is even greater. Yet we go on building in a most slovenly manner from mere force of habit, folly, and, in a vain endeavor to recoup ourselves for possible or certain loss, we go into a most unprofitable gamble with the insurance companies.

No country on earth builds as rapidly as we, and no country on earth needs to, for not one destroys its buildings as rapidly as we do. Not even in Japan and China, the lands of bamboo and paper, are the fire losses as great, pro rata of population, as numerous or in any way equal to the really immoral losses we indulge in. This year is a phenomenal building one. It never has been equaled. The total will probably reach \$750,000,000. Of that vast sum, there will probably be spent not over \$75,000,000 in reasonably safe construction and not \$10,000,000 in absolutely fireproof construction. Ratios that are far from comforting, and that proclaim very loudly that our so-called progress in construction is somewhat of a figment of the imagination. We have built so *well* that normally our fire losses have reached the \$200,000,000 mark per annum. But that is normally; 1904 went up to \$230,000,000 on account of the Baltimore fire; San Francisco's fire assures that 1906 will reach \$500,000,000 at least, and what assurance have we that some other great abnormal disaster will not wipe up fifty or so million more? Have we not built so poorly that from now on we must expect that the abnormal year will be, not the one of great disasters, but the one of normal loss?

SAN FRANCISCO'S FIRE

Take that one fire in San Francisco as an example of our folly in building. It certainly laid bare egregious stupidity on the part of the architects, authorities and builders. The actual destruction of buildings means \$315,000,000 wasted in smoke; \$1,000,000,000 in business lost to it and the country generally; \$12,000,000 to clean up the débris, and \$350,000,000 more and twenty years' time to put the city even in the condition that it was before. The sum of those figures

represents the cost of that fire, to counterbalance which the people *may* receive the paltry sum of \$132,823,067 from the insurance companies. Surely this is not a profitable gamble.

By way of illustration of the imbecility of poor construction, it is well to note that had \$10,000,000 more been spent originally in sane construction, it would

We say that San Francisco was stupid, simply because her stupidity has been exposed. True, she and New Orleans were at the tail-end of cities as regards excellence of building, but, nevertheless and notwithstanding, just as appalling a catastrophe is liable to happen in 60 per cent. of our cities.

What people consider the excessive cost of fireproof construction is brought about by the fact that there is so much to burn all around that to be immune one has to take extraordinary precautions. Were we all intelligent enough to build properly, paradoxical as it may seem, there would be little occasion for absolutely fireproof construction; to make buildings incombustible would be all that is necessary.

Apart from all this, there is one other point we have not even touched upon, yet surely it is worthy of our most solicitous attention. We have gotten to the pitch when nearly 7,000 lives are annually wiped out by fire, and every day in the year there are 36,000 lives directly exposed to destruction, people carried out of burning buildings, people who escape to adjacent roofs, etc., in direct jeopardy. New York averages 7,800 fires a year; Chicago, 4,100; or in detail, we burn up 3 theaters, 3 public halls, 12 churches, 10 schools, 2 hospitals, 2 asylums, 2 colleges, 6 apartment houses, 3 department stores, 2 jails, 26 hotels, 140 flat buildings, and 1,600 homes every normal week. Think of the number of lives in danger. But that is the ravage of fire in a normal week, I say; forty-eight hours sufficed in San Francisco to wipe out twelve square miles of territory, 700 city blocks, or nearly 20,000 buildings.

In a most exhaustive examination of the results of that horrible fire, we found nothing that was not perfectly known to fire experts before, nothing new for us to preach about, the same old folly of using wood and the same mistaken zeal in applying the term "absolutely fireproof" to a building whose structural parts alone were incombustible and protected. The standard of a perfect building remains just as it was before, and we can but reiterate our advice, our prayer, even though it but results in a sort of John the Baptist wail in the desert.

GOOD FOUNDATION ESSENTIAL

The first essential of the good building is a good foundation. Where there is not a hard bottom use caissons and concrete piers or a reinforced concrete pile, anything that secures a firm broad base, substantial foundations for walls and columns. For the exterior I would build of well burned brick and terracotta trimmings. That some terracotta went all to pieces in San Francisco is neither here nor there. It was not well made and is no argument against the

material itself. It must be patent to even the most obtuse layman that at least on narrow streets or wherever exposed to external fire, granite, marble, sand and limestone, concrete, artificial stone or stucco is bound to spall and be damaged even beyond repair. The steel frame must be perfectly held together. All the steel work must be thoroughly coated with cement and protected from fire with brick or hollow fireproof tile. The floor construction and partitions should be of hollow fireproof tile of narrow span and well built with cement and tied to the steel work. Where, in lieu of steel, reinforced concrete has to be used, it in turn has to be protected from fire.

We hear a good deal of the fireproof qualities of concrete, but San Francisco and every other fire have fully demonstrated, even if our own good sense did not tell us, that it is utter folly to call any material "fireproof" that loses 50 per cent. of its efficiency in 750 degrees of heat, when a most ordinary blaze is apt to develop from 1,500 to 2,000. The finished floors and the interior trim should be of cement or marble or asbestos, something incombustible, the doors themselves should be of metal or other incombustible material, and where there is the slightest danger from external fire, the windows should be protected with metal or other incombustible sash and wired glass. The interior of the building should be cut up into as small units as possible. Great expanses of floor are much desired by retailers, but the comparatively small unit is the only safe one. Elevator and stair shafts must be closed at every story and with automatically closing fireproof doors. That secures the immunity of storeys. Fittings and furniture should be metallic as much as possible. The main stairway should debouch directly to a street, and, the natural and daily means of ingress and egress to the building, it logically becomes also the natural fire-escape in case of danger. Every precaution should be taken so that in incipient fires, that are bound to occur, they can be successfully fought and restricted to the one little unit in which they originated. Fire-fighting appliances should be freely installed and employees trained in their use.

In such a building, and in such a one only, is there absolute immunity from destruction by fire. The tenants' property can suffer only from insignificant local blaze. His interests are best safeguarded in such a structure, and the owner has a permanent non-damageable investment. Such a building is not an unattainable affair. To do all these things well entails skill on the part of the designer, but even the first cost of construction is surprisingly little over that of the most flimsy affair.

Water Meters in Chicago

ON account of the shortage of water in many parts of the city, the Chicago, Ill., City Council must take action either by establishing more pumping plants, or making the present plants more serviceable by installing the meter system. Former City Engineer John Ericson last year estimated that the cost of fuel alone to pump useless water into the mains was \$200,000 per annum.

PRICES PAID IN CERTAIN CITIES FOR ELECTRIC LIGHTING

COMPILED BY THE
OFFICERS OF THE CITY OF DULUTH, MINN.
BY CORRESPONDENCE

(Courtesy of H. W. CHEADLE, City Clerk)

MUNICIPALITY	PRICE OF INCANDESCENT COMMERCIAL LIGHTS		ARCS		INCANDESCENTS FOR STREETS		Competition	Power Used
	Cents Per K. W.	Discount	Price Per Year	Candlepower	Price	Candlepower		
Augusta, Ga.	12	5% to 60%	\$68.00	2,000 nom.	Not used		No.	Water
Atlanta, Ga.	12		75.00	450 watts	\$33.75	75	No.	Water
Albany, N. Y.			97.00	2,000 act.	Not used		No.	Steam
Akron, Ohio	12		70.00	2,000	Not used		No.	Steam
Auburn, N. Y.	15		68.00	2,000 nom.	\$34.00	65	Yes.	Steam
Baltimore, Md.	10 cents and free renewal	3 cents per K. W. if light used 15 hours	67.49	2,000 nom.	Not used		Yes.	Steam
Butte, Mont.	16	25% summer, 10% winter	110.00	2,000 act.	Not used		No.	Water
Boston, Mass.	15	For over 12 lights	105.00	2,000 nom.	1 cent per K. W. hr.	16	No.	Steam
Birmingham, Ala.	12		75.00	2,000 nom.	Not used		No.	Steam
Buffalo, N. Y.	9 to 4		56.00	2,000 nom.			Yes.	Water
Binghamton, N. Y.	15	10% to 30%	83.95	462 act.	\$21.50 a year	105 watts	No.	Steam
Canton, Ohio	11	10% to 50%	64.00 to \$60.00	460 watts	6 cents	10	No.	Steam
Cincinnati, Ohio	10	Yes	60.00 overhead, \$72.00 under ground	600 act.	10 cents per K. W.	16	Yes.	Steam
Cambridge, Mass.	15 to 10		90.00	1,200 nom.	\$30 a year	40	No.	Steam
Cleveland, Ohio	12 1/2 to 5 cents		69.72	2,000	Not used		No.	Steam
Columbus, Ohio	5 cents proposed		22.00 operating cost; \$49.15 total	2,000 nom.	Not used			Steam
Chelsea, Mass.	10		\$100.43	2,000	\$28.97 mantle l'ts.	60	No.	Steam
Dallas, Tex.	10 to 7		73.00	2,000	Not used		Yes.	Steam and oil
Dubuque, Ia.	8 to 6		64.75	2,000 act.	Not used		No.	Steam
Detroit, Mich.	16 to 4		34.99 net, \$59.34 gross	2,000 nom.				Steam
Duluth, Minn.	6 to 10	20%	\$55.00, 50 free lights	2,000 nom.	\$9.00 per year	16	No.	Water
Evansville, Ind.	10	Net	\$67.00	2,000			No.	Steam
Elizabeth, N. J.			92.50	2,000	\$15 a year, Gas.	16	No.	Steam
Elmira, N. Y.	10 to 15		80.00	2,000 nom.	\$0.822 per light for all night and 5 1/4 cents per K. W., moonlight	60	No.	Steam
Erie, Pa.			\$58.40	2,000 nom.			Yes.	Steam
Fall River, Mass.	15	5% to 40%	109.50	2,000 nom.			No.	Steam
Grand Rapids, Mich.	12 to 6	10%	35.14	2,000 act.			No.	Steam
Hoboken, N. J.	10		100.00	2,000 nom.	10 cents per K. W.	16	Yes.	Steam
Hartford, Conn.	13 to 10	5%	70.00	1,200 nom.	\$18.00 per year	Double series lamps	No.	Steam and water
Holyoke, Mass.	12	2 cents	80.00	6.6 amp.	Not used			Water and steam
Harrisburg, Pa.	10	5% to 25%	47.00	2,000 nom.	\$38.50 for 100, 26.00 for 50, 22.00 for 25		Yes.	Steam
Houston, Tex.	12	Yes	\$85.00	2,000 nom.			No.	Fuel oil
Indianapolis, Ind.	10		74.00		Not used		Yes.	Steam
Jacksonville, Fla.	7	None	90.00 for 9.6 amp, 54.00 for 4 amp	9.6 amp	\$25.00	50		Steam
Jersey City, N. J.			97.50	2,000 nom.	Not used		No.	Steam
Joliet, Ill.	9	Net	78.50	2,000 nom.	Not used		No.	Water
Knoxville, Tenn.	10	20%	72.48	2,000 nom.	Not used		No.	Steam
Kansas City, Mo.	Small, 7 to 10 cents; large, 3 to 5 cents		65.00	2,000 nom.	Not used		No.	Steam
Kansas City, Kan.	10		64.92	2,000 act.	\$19.92	25	No.	Oil
Lincoln, Neb.			73.68	2,000 nom.				Steam
Lancaster, Pa.	6		80.00	2,000 act.	Not used		No.	Steam and water
Los Angeles, Cal.	4 to 11		70.60	450 watts	5 cents per K. W.	16	No.	Steam and water
Lowell, Mass.	11 Com. C.L., 5 to city		100.00	2,000 act.	\$22.50 a year	40	No.	Steam
Lynn, Mass.	13	1 cent	98.55	2,000 act.	\$16.50 a year	25	No.	Steam
Manchester, N. H.	15	Net	90.00	7 1/2 amp	Not used		No.	Steam and water
Memphis, Tenn.	10		85.00	2,000 act.	Not used		No.	Steam
Newark, N. J.	5 to 12		95.00	2,000 nom.	15.00 for 25, 16.00 for 32		No.	Steam
New Bedford, Mass.	18	5% to 25%	98.55	1,200 nom.			No.	Steam
New York, N. Y.	10 to 3		90.00	1,200 nom.	\$22.50 and \$25.00	25	No.	Steam
New Haven, Conn.	12 1/2		100.00	2,000 nom.		100 watt		
Omaha, Neb.	15	10% to 50%	65.00, 75.00 less 3% gross earnings	2,000 nom.	Not used		No.	Steam
Oakland, Cal.	10	5 to 60%	84.00	1,200 nom.	5 cts. per K. W.		No.	Steam and water
Portland, Me.	10	10%	61.00	1,200 nom.	\$28.80	65	Yes.	Water and steam
Peoria, Ill.	10		65.00	2,000 act.	\$20.00	32	No.	Steam
Providence, R. I.	20	20%	109.50	2,000 act.	\$24.00	32	No.	Steam
Pittsburg, Pa.			75.00	2,000 act.	Not used		No.	Steam
Philadelphia, Pa.	20 to 2		99.42	9.6 amp, 47 to 50 volts	7 1/2 cents per K. W.		No.	Steam
Portland, Ore.	15 to 5	5%	63.60	2,000 act.			Yes.	Water
Norfolk, Va.	10 to 6	10%	58.00	400 watts	Not used		No.	Steam
Quincy, Ill.	13 1/2 to 7		55.00	2,000 act.	Not used		No.	Steam
Richmond, Va.	10	Yes	54.75	6.6 amp	Not used			Steam and water
Reading, Pa.	12	5% to 60%	78.00	2,000 act.	\$19.20	20	No.	Steam and water
South Bend, Ind.			78.75 to \$95.00		\$32.00	50		
Rochester, N. Y.	9 to 3		78.47 single lamp, \$66.61 double	450 watts single, 360 double	3.6 to 9 cents per K. W.	16	No.	Steam and water

PRICES PAID IN CERTAIN CITIES FOR ELECTRIC LIGHTING—Continued.

MUNICIPALITY	PRICE OF INCANDESCENT COMMERCIAL LIGHTS		ARCS		INCANDESCENTS FOR STREETS		Competition	Power Used
	Cents Per K. W.	Discount	Price Per Year	Candlepower	Price	Candlepower		
Springfield, Mass.			85.00 under ground, and \$73 overhead.	1,200.	\$15.00.	40.		Steam
St. Joseph, Mo.	10 to 5½.		\$50.71.	2,000.	Not used.			Steam and gas
Superior, Wis.	12½.	2½ cents.	70.00.	540 watts.	10 cents a K.W.		Yes.	Steam
Spokane, Wash.	5 to 13.		48.00.				No.	Water
Saginaw, Mich.	17 to 8.	10%	65.00.	2,000 act.	6 cents per K.W.	16.	No.	Water
Scranton, Pa.			73.00.	1,600 nom.	Not used.		Yes.	Steam
Springfield, Ill.	4 to 13.		60.00.	2,000 nom.	Free.		No.	Steam
Syracuse, N. Y.	10.	Net.	85.70.	2,000 act.	Not used.		No.	Steam
Salem, Mass.	20.	25% to 50%	95.00.	385 watts.	\$22 a year.	120 watts.	No.	Steam
Salt Lake City, Utah.	11.		72.00.	455 watts.	Not used.		No.	Water and steam
Seattle, Wash.	8 to 7.		66.00.	6 amp., 72 volts.	\$15.00.	30.		Water and steam
Sioux City, Ia.	12.	5% to 40%	75.00.	2,000 act.	\$15.00 a year.	25.	No.	Steam
San Francisco, Cal.	9 to 5.4.		70.00 to \$84.00.	2,000 act.	Not used.		No.	Steam
San Antonio, Tex.	20.	10%	80.00.	480 watts.	10 cts. per K.W.		No.	Steam
Tacoma, Wash.	6 to 3.		60.00.	1,200.	Not used.		Yes.	Water
Topeka, Kan.	10 to 6.		40.00.	2,000 act.	Not used.			Steam
Trenton, N. J.			85.00.	2,000 act.			Yes.	Steam
Worcester, Mass.	12.	10% to 50%	91.25.	500 watts.	Not used.			Steam
Washington, D. C.	10.	Net.	85.00.	1,000 act.	\$20.00.	25.		Steam
Wilmington, Del.	5 to 10.		62.92.	2,000 nom.	\$14.68 per year.	24.	No.	Water and steam
Waterbury, Conn.	5 to 10.	Net.	87.00.	400 watts.	\$20 a year.	25.	No.	Steam
Youngstown, O.	6 to 12.	33½%	64.00.	2,000 nom.	6 to 12 cents a K.W.		No.	Steam
Yonkers, N. Y.	15 to 5.		107.00.	6.6 amp.	\$20.50.	25.	No.	Steam

The following cities have municipal lighting plants: Columbus, Ohio; Detroit, Mich.; Grand Rapids, Mich.; St. Joseph Mo.; Topeka, Kan.; Seattle, Wash.; Holyoke, Mass.; Jacksonville, Fla.; Lincoln, Neb.

The following cities run on a Moonlight Schedule: Akron, Ohio; Auburn, N. Y.; Dubuque, Ia.; Evansville, Ind.; Lynn, Mass.; Sioux City, Ia.; Tacoma, Wash.; Youngstown, Ohio.

An examination of the figures in the above table shows that in fifteen cities there was lighting competition, while in fifty-nine there was none; ten failing to report. That fifty-seven plants were run by steam alone, ten by water alone, thirteen by water and steam, two by oil, and one each by steam and gas and by steam and oil.

In twenty-seven cities reporting the use of 2,000 c.p. nominal arc lights furnished by private plants, the average price was \$76; while in the five cities having municipal plants the cost was \$56.64; the lowest being \$47 and the highest \$109.50, both private plants. In the nineteen cities reporting the use of 2,000 c.p. actual arc lights by private plants the average price was \$80.83, the lowest \$55 and the highest \$110; the two having municipal plants reporting the cost as \$35.14 and \$40, respectively. In the nine cities reporting the use of 1,200 c.p. nominal the average price is \$72.78. In the three using 450-watt lamps the average price is \$77.69 (450 watts is about sufficient for a 2,000 c.p. nominal lamp); and the average price in the two cities calling for 455-watt lamps was \$85.71. Of each of the other candle-power and watt intensities, there is but one user; these varying from 1,600 c.p. nominal at \$73 to 462 c.p. actual at \$83.95; and from 540 watts at \$70 to 385 watts at \$95.

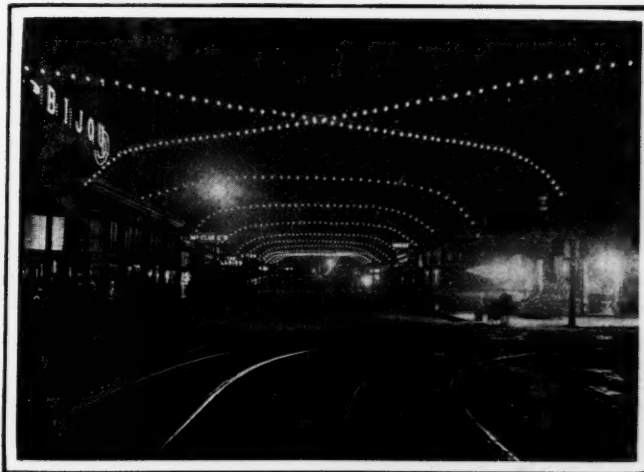
In the nine cities using 16 c.p. incandescent lamps the average price of these was 7.55 cents per kw.; and in the nine using 25 c.p. lamps the average price is \$19.05; the range of prices being from 3.6 to 11 cents per kw., and from \$15 to \$22.50 a year.

If any errors are found in this table, we hope that the attention of the MUNICIPAL JOURNAL will be called to them, and such corrected data will be published in a future number.

A STRIKING EFFECT IN STREET LIGHTING

THE accompanying illustration is a view of the main street intersection in Birmingham, Ala., and presents a faint idea of the striking appearance of the street illumination at that point. The lighting of the city is done under contract by the Birmingham Railway, Light and Power Company, which has here utilized its trolley guard spans by suspending from them incandescent lamps so as to form the line of a flat arch. The effect is almost that of a roof of light. This, of course, is not economical as a method of street illumination.

A similar effect has been obtained at Wapakoneta, O., where the lighting is performed by a municipal plant. Here light trusses of steel angles span the street, forming arches more true and permanent in line than those in Birmingham, to which arches the lamps are fixed.



STREET ILLUMINATION IN BIRMINGHAM, ALA.

STREET CLEANING

Data Collected from 210 United States Cities—General Insufficiency of Records—Hand Sweeping Cheaper than Machine—The Plan Recommended

By T. CHALKLEY HATTON, M. Am. Soc. C. E.*

THE cleaning of streets has become a problem which during the past few years has caused the municipal officers having the matter in charge many wakeful nights following days of numerous complaints from righteously-indignant citizens, and if this paper in any way alleviates the suffering of either, the writer will feel that the time expended upon its preparation is not wasted.

In attempting to prepare a paper which may assist the municipal officers aforesaid, the writer has encountered the utmost difficulty in securing comparative costs of street cleaning, and if he had been less familiar with the quality of work done in the several cities from which information was obtained, the comparative costs, as obtained, would, when placed side by side, have been ridiculous; but his personal knowledge of the several cities led him to see that the cleaning of streets was performed on a basis of the officers' "points of view," which was largely governed by the point of view of the average citizen and what had been done by those who preceded him in performing this duty. For instance, one city of 80,000 population expended in 1905 only \$6,000 for cleaning its streets, or seven cents per capita. That would seem to the average reader to indicate that this city was being ably and economically managed, whereas the writer, during a recent visit, found the conditions of the streets to be filthy in the extreme; and this illustration will fit almost any other city in this country which shows a per capita cost for cleaning its streets of less than forty cents. One of the most important duties of a municipal government is to keep its streets clean. It should not be content to sweep them occasionally, say once or twice a week, where built up, but no organic matters subject to decomposition should be allowed to remain upon the surface of the streets beyond a few hours at most.

The householder is required by the Boards of Health to remove from his premises all organic matters subject to decomposition for which he has no longer any use. Should his back or front yard become dirty from such organic matters, he is fined and made to clean up, when at the same time the municipal government is permitting horse droppings and vegetable refuse to lie for days at a time within a few feet of his front windows and doors, unless a windstorm has come along and removed it inside his premises, which is often the case.

STREET CLEANING GENERALLY NOT THOROUGH

Animal and vegetable wastes, when dried, as they are after lying upon the surface of the streets for a few hours, are harmful to the human system. They find lodgment in the membranes of the nose, mouth, ears and eyes, and

become an irritant which largely induces catarrhal trouble, which is so very much more prevalent in the cities of the United States than in the European cities, where the streets are kept so much cleaner. The citizens of the average place where the streets are not well cleaned gets more or less accustomed to seeing horse droppings lying undisturbed upon the streets, and thinks little of it; but after he has lived in a city where these droppings are allowed to remain only long enough to get them, while fresh, into a receptacle, he changes his point of view very much and views such dirt with feelings of disgust, and he has become a better citizen for having that feeling.

Before Colonel Waring undertook to clean the streets of New York in 1895, he stated that they were almost universally in a filthy state. In wet weather they were covered with slime, and in dry weather the air was filled with dust. Artificial sprinkling in summer converted the dust into mud, and the drying winds converted the mud to dust. This is a very fair description of the condition of the streets as they exist to-day in the majority of the cities of the United States, and yet large sums are annually expended by these cities for cleaning the streets, just as New York expended large sums prior to 1895 for attempting to keep its streets clean. The trouble seems to lie not in the smallness of the appropriations, but in the lack of system adopted by the average city official in having the work performed and the failure to have the laws observed which are usually a part of every city's code.

For instance, the writer has frequently observed the surface of main streets in cities littered with papers, fruit skins, ashes, sweepings from stores and dwellings, where he knew ordinances were in existence prohibiting the depositing of all these substances upon the streets. He has observed, as all of you no doubt have done, pedestrians throwing whole newspapers in the streets, banana skins and other like matters also being thus disposed of while a policeman was standing by but paid no attention to this infringement of the law. He has seen the janitors of stores and business houses in entire blocks cast the sweepings in the street gutters without being molested by the conservator of the law as he patrolled the sidewalk in front of these stores, and yet there was an ordinance prohibiting this.

The writer believes the streets should be cleaned thoroughly and be so maintained, but he also believes that it should be the duty of every citizen to do his share towards preventing the littering of the streets, and he also believes that every good citizen concedes this point. Then the first point to be solved by the city official having the

*Paper read at the 13th Annual Convention of the American Society of Municipal Improvements.

cleaning of the streets in charge is to prevent their becoming dirty so far as he is able under the law. To do this he must call in the assistance of the Police Department and have the police instructed to have the ordinances fully carried out. This step, if honestly and firmly performed, will soon change the point of view of the whole city, as your point of view is changed in the European cities if you attempt to throw a piece of paper upon the surface of the streets in sight of a policeman. This is not a hardship to the average citizen, and the writer has seen its wholesome effects in many instances. In fact, the citizen soon prides himself in being a part of a community which carries out such a law, and becomes more careful of his person and premises. It is of twofold assistance to the young in that it practically educates them to a spirit of tidiness. Colonel Waring organized the youngsters in the slums of New York into street-cleaning leagues, and the writer has done the same, with the result that this class of ordinarily careless children became tidy and careful of their personal appearance, and these lessons go with them throughout their lives. It is a noted fact that wherever a municipality improves the appearance of its property, either by sewerage, paving, parking or cleaning, the owners abutting upon that property will follow suit. Clean streets lead to clean houses and tidy people, and thus the whole community is benefited by the municipality keeping its own territory clean.

There is no universal system of street cleaning in use in this country, in spite of the fact that all the large cities of Western Europe have had a universal system in use for many years, with great success. In this respect we have not been benefited by the experiments made by our neighbors across the deep, although we do follow their lead in nearly all other municipal improvements. We look upon ourselves as the greatest people living because we have not studied closely the ways and means of our European friends in accomplishing results which we are still far from having accomplished, and the American municipal officer traveling abroad sees at once how far behind we are.

LACK OF OFFICIAL DATA

The official of one American city will declare with the greatest confidence that the methods of cleaning the streets as practised in New York City or Washington cannot be successfully carried out in his city because the conditions are different, whereas as a matter of fact he cannot clearly demonstrate the difference in conditions, because there is none. He will positively assure you that hand cleaning as a constant operation is far more expensive than machine cleaning, and when you request his proof he cannot produce it, because he has kept no accurate record, but from an occasional observation of the two methods he jumps at the conclusion that the machine is far cheaper.

For instance, the writer received replies from the officers of 210 cities of the United States to the question, "Which, in your opinion, is the cheaper method of cleaning streets, machine or hand?" and all the replies from

those cities where no records were kept were to the effect that machine cleaning was far cheaper, whereas the replies from those cities where accurate records were kept proved without doubt that hand cleaning was much cheaper. These facts are here stated to show what a lack of information there is upon the subject, and until city officials study the question of street cleaning in a rational manner our streets will still be cleaned in the same old slipshod, extravagant manner as most of them now are.

DATA CONCERNING STREET CLEANING

It might be well at this point to outline briefly what the writer learned from the replies received to a circular letter sent to the Mayors of those cities of the United States east of the Mississippi having a population of over 20,000.

Of the 210 cities, 81 cleaned by hand alone by day labor employed under the direction of the Street Commissioner or a deputy; 115 cleaned by both hand and machines by day labor; 9 cleaned by machine and hand by contract; 1 cleaned by hand and machine by prisoners; 1 of over 45,000 population cleaned by private subscription only, and then at irregular intervals.

In 133 cities the sweepings were used for filling in low places on outlying streets and private grounds. In 49 cities the sweepings were used as a fertilizer. Of the 115 cities cleaned by both hand and machine by day labor, 72 used the hand labor exclusively by day, by which all paved streets in the business districts were cleaned once a day at least. The residence streets which were paved were cleaned from once a day to three times per week, the machines being used by night only. In 57 cities the two-wheel hand vehicle was used to retain the sweepings temporarily as they are swept up by hand, this vehicle having either a bag or metal barrel; the bag, when full, to be tied up and deposited upon the curb line, to be removed by the horse wagon following the sweeper. In 37 cities the sweepings as they were gathered by the "white wings" were deposited in the nearest manure pit, and in 20, carts followed the "white wings," picking up the bags of sweepings left along the curb and leaving fresh bags for the sweepers. Of the 115 cities which cleaned by both hand and machine by day labor, 96 sprinkled the streets ahead of the machines; the others apparently allowed the dust to fly. Eight cities cleaned their business sections after closing hours by flushing the streets from the fire hydrants and allowing all the dirt to wash into the sewers through the inlets.

There are several interesting points brought out in examining the results of these replies. One is that the majority of cities find that the street cleaning is best accomplished by day labor and not by contract; another, that machine sweeping is not popular if done during the day, owing, no doubt, to the interference to travel and the dust which is thus bound to be raised; again, that business streets are, in the main, cleaned once a day; residence streets, paved, were cleaned on an average of three times per week; gutters in suburban districts cleaned upon complaints of the property owners. As stated, there

were 49 cities where the street sweepings were used as fertilizer, and from the writer's personal knowledge of these cities, they are surrounded by the most fertile lands with the most prosperous agricultural communities, from which the writer naturally concluded that these communities have been indirectly enriched by using good sense, and that it will be largely beneficial to any municipality to carefully gather up its street dirt, which is largely composed of manure, and deposit it upon piles or beds in different sections of the suburban districts, making a compost of it, and then permitting the farmers and truckers to remove this compost to the surrounding lands. The municipality will certainly be the winner in the long run by this system of disposal, even though its first cost is greater than the present popular system of wasting this manure upon city dumps. Just think a moment of what this popular system is. One hundred and sixty-one cities in the United States east of the Mississippi river sweep up the manure which falls upon the streets, the vegetable refuse which is found more or less in all street sweepings, and the many other organic matters also found therein, and dump them in the partially opened streets, or upon low private grounds inside the city limits, where the organic matter of which they are largely composed is permitted to decompose so long as it is exposed to light and air, and the process of decomposition poisons the atmosphere of the entire neighborhood. Much of this organic matter is covered before it is entirely decomposed, but a few years thereafter, as the growth of the city requires, these low grounds which have thus been filled up with this manure are improved by building thereon residences, and when the occupants of these become ill they call it malaria, whereas they are being poisoned by living over a manure pile. Such a practice disgusts the senses of refinement of all when they are asked to look squarely into it, and yet it is the practice of 75 per cent. of the cities of this continent, cities which annually expend immense sums for sewers and pure water and for the observation of sanitary regulations. Seems ridiculous, does it not? But it is the result of following an old custom. Let us get out of this old custom and solve this question in a rational manner. Let us spend a little more ready cash upon sweeping our streets and in properly disposing of the sweepings by utilizing them for fertilizer, as is done successfully by many European cities and as we have so much opportunity for doing.

HAND SWEEPING CHEAPER THAN MACHINE

As has been asserted earlier in this paper, the cost of sweeping the streets is known to but few of the officers of the cities who answered the writer's questions. In fact, there were but 22 cities where the officers in charge could tell how much per mile it was costing to sweep the streets, and of these only 13 could tell the relative cost of cleaning by hand and machine; and yet there was expended for this purpose in 1905 millions of dollars, all for surface work of such a character that a good clerk working on an average of two hours per week for fifty-two weeks at a total cost of, say, \$50 could have deter-

mined what the unit cost of street cleaning was in the average city.

As hereinbefore stated, the answer to the question, "How does the cost of machine cleaning compare with the cost of cleaning by hand?" was, "The machine cleaning is far cheaper," except from those 13 cities where accurate records were kept and which showed beyond a doubt that the hand cleaning was by far the cheaper process. The writer some weeks ago called upon the Street Commissioner of a city of 90,000 population and asked him the above question, and the reply was, as usual, "Machine cleaning about one-third the cost"; but no accurate records had been kept, although both processes were in use. We went together upon the streets to view the work being done, and incidentally the cost, with the following result: One "white wing" had a district comprising the leading business street of the city, upon which two car lines were maintained. The street was paved with bricks, asphalt, bituminous macadam and granite block. The district cleaned by this one man was 2,700 feet long by 40 feet wide, and he got over it entirely once a day for every working day in the year, except when it rained or snowed. His wages were \$9 per week. The sweepings were dumped by him in the nearest stable manure pit, which in some cases was two blocks away. We found by this method that this street was being cleaned for \$1.25 per 10,000 square yards. Upon an adjoining residential street, paved with bricks, the machine gang was then at work, and consisted of one two-horse sweeper, one two-horse sprinkler, six one-horse carts, one foreman and eleven men. Double teams, 50 cents an hour; single teams, 31¼ cents; foreman and six men, 20 cents; five men, 17¼ cents; the sweepings were being hauled 5,700 feet average haul, and dumped upon low ground. This gang cleaned at the rate of 3,305 square yards an hour, and at that rate the cost was \$15 per 10,000 square yards, or over ten times the cost of sweeping by hand. It is needless to add that the result of our investigation changed the opinion of that Street Commissioner, as it will do that of any other who will take the time and trouble of looking into it, remembering that the same condition of street must be maintained by either process.

The result of the writer's investigation has shown that the cost of sweeping streets by machine averages \$7.53 per 10,000 square yards; by hand, \$2.45 per 10,000 square yards, and flushing streets about \$3.18 per 10,000 square yards; that the cost per capita per annum for cleaning streets in the cities east of the Mississippi was, in 1904 and 1905, 53 cents, and that the cost in those cities which kept their streets well cleaned was 75 cents per capita per annum, the last-named sum being a very reasonable one when it is considered what it secures.

PLAN FOR CLEANING RECOMMENDED

The writer is of the opinion that the best results, both as to quality and economy, can be secured by cleaning paved streets by a well-organized and efficient force of "white wings," by which the sweepings are collected and deposited in bags upon the curb lines, to be picked up by

carts which haul these sweepings to a compost dump located as near as possible to the district cleaned, when, after adding some hypophosphate, the farmer is invited to come and haul it away. He believes that the cleaning should be done so frequently that no organic matters should be allowed to remain upon the surface of any streets for more than twelve hours, and in the business streets, where the travel is heavy, the cleaning should be done constantly by "white wings," having but 2,500 square yards of surface to cover per day per man.

After the business of the day is over, a gang of men should flush the surface of every business street by means of hose attached to fire hydrants, and thus dislodge the fine dust left upon the surface by the hand broom. In the morning the street thus flushed presents a clean, pleasant appearance, and it is free from those harmful dust compounds which induce catarrh and other throat troubles. This process, properly administered, is within the means of any city, large or small—the smaller the city, the easier the process becomes. The cleanest-kept city in the United States to-day is Washington, and it has the largest street area per capita. The next cleanest-kept city is Greater New York, where the obstacles to maintaining clean streets are far greater than any other city of the United States.

As an adjunct to the street cleaning process, laws should be passed and observed for preventing the unnecessary littering of the streets, and towards this end the city should erect and maintain proper receptacles upon the street corners for holding waste papers carried by pedestrians and fruit peelings or other things thrown away by those who use the public streets; and no business house should be permitted to sweep the dirt from its building upon the streets. Instruct your police force that these laws must be rigidly enforced; then note how proud you will be at the end of a year that you are a part of such a community.

In closing this paper the writer desires to cull out from its contents a few of what he considers its most important points. A well governed city can only be so considered when its streets are maintained constantly in a cleanly condition, and that no matters subject to decomposition should be allowed to remain upon the surface of the streets for a greater period than twelve hours.

A well organized hand cleaning force of street cleaners is by far the most efficient and economical method of keeping the streets clean.

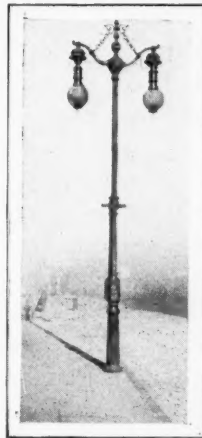
The streets sweepings should be utilized as fertilizer and never used for filling in low lands liable in the future to be used as building sites.

Flush the surface of the business streets every night with an abundant supply of water, so as to remove the harmful dust.

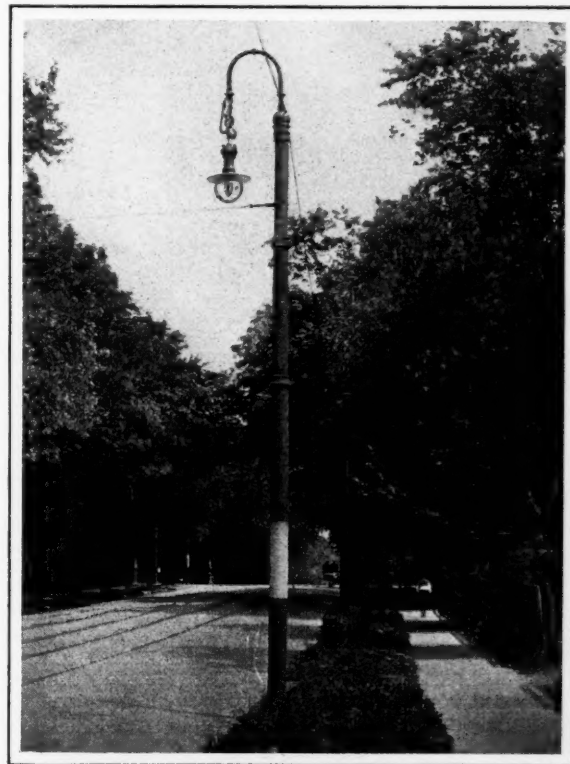
Keep an accurate account of the cost of cleaning the streets by any particular method in use, and so itemize such cost as to be of use to your colleague in a neighboring city.

Provide receptacles upon the corners of the streets for retaining waste materials in the hands of pedestrians, and cultivate cleanliness and tidiness in the minds of your school children by an occasional talk to them by one of the leading city officers.

DISTRIBUTION OF ROCHESTER'S STREET LIGHTS



ONE of the best lighted cities in the country is Rochester, N. Y. The city pays for 2,712 single arc lamps, and 495 arc lamps hung in pairs. The lamps average one for each 4.2 acres of total area, or $8\frac{3}{4}$ per mile. The spacing in the main streets is determined to a considerable degree by that of the trolley poles, to which a large percentage of the lamps are fastened. On Main street the two principal street crossings have four double arc lamps, one on each corner; the other street crossings two to a corner. In a distance of 6,400 feet there are 122 lamps in 61 pairs, or one pair to each 105 feet, an average of one lamp for each 52 feet. On eight miles of streets are 480 lamps hung in pairs, an average of 60 lamps per mile, or one for each 88 feet. The rest of the city is lighted largely by single arc lamps attached to wooden poles, at an average distance apart of 360 feet.



San Francisco Lighting Rates

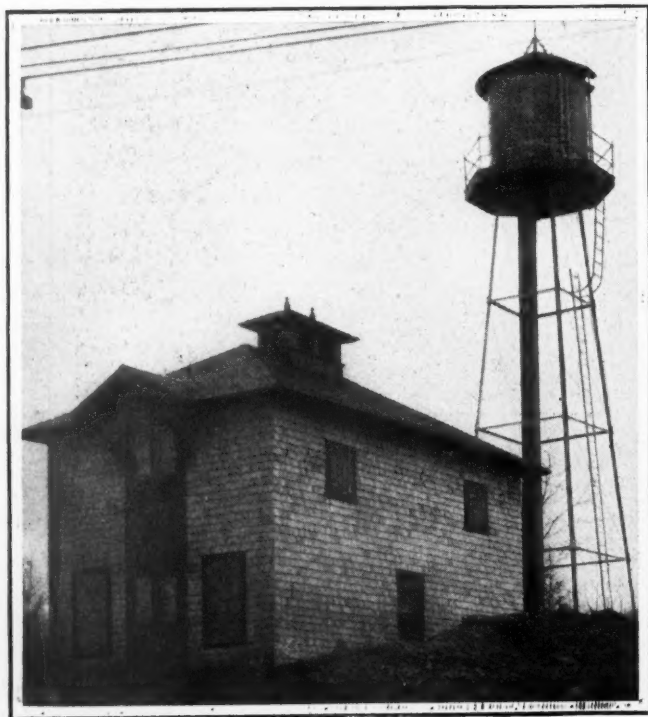
THE San Francisco Gas & Electric Company has reduced the rates for both gas and electricity. To consumers of 10,000 cubic feet of gas the rate will be 85 cents per 1,000, and to consumers of 75,000 cubic feet 60 cents. On electricity the new rates will be for 375 to 649 kilowatt hours $5\frac{1}{4}$ cents per kw.; for 650 to 924 kilowatt hours 5 cents; from 925 to 1,199, $4\frac{3}{4}$ cents; from 1,200 to 1,475, $4\frac{1}{2}$ cents; from 1,475 to 1,749, $4\frac{1}{4}$ cents; from 1,750 or over, 4 cents.

ACETYLENE TOWN PLANT

Used Successfully in Communities under Five Thousand Inhabitants—Experience of Tiverton, R. I., with This Method of Lighting

ACETYLENE, the existence of which as a simple gas has been known for seventy years and whose composition was found by Berthelot, forty years ago, to be of equal parts of hydrogen and carbon, was of little commercial value until the process of manufacturing calcium carbide from coke and lime in an electrical furnace had brought the price of that material down to about \$70 per ton. This price did not at once place the acetylene lighting business on a successful basis, but during the last decade improvements in the manufacture of machines have opened a wide field to the operation of this industry. Calcium carbide, as soon as exposed to the action of water, is decomposed and acetylene set free. The value of this gas as an illuminant is due to the brilliance and agreeable quality of the light as well as to the safety of the process.

There are said to be 231 municipal acetylene plants now in use in this country. For towns of from one to five thousand inhabitants, which are too small for the successful operation of a coal gas plant, they have the advantage of offering a system of lighting not under the control of the consumer, so far as responsibility for the generation is concerned. A plant of this sort has recently been built at Tiverton, R. I., a town of about 3,000 inhabitants, where a J. B. Colt Company 1,000-pound Municipal Generator was selected. This generator requires no other motive power than that supplied by a small water motor to feed the carbide operated from the tank of water above the generator building, as shown in the illustration. Carbide



ACETYLENE PLANT AT TIVERTON, R. I.

is fed into the tank of water in the generator where it falls upon a wire screen and is exposed to a large volume of water in order to facilitate disintegration at a sufficiently low temperature; the bell top of a regulator near by rises as it becomes inflated with gas and checks the feed; when the bell falls from the use of gas, the feed starts again. Thus the works are automatic and no large gasometer is required. This little plant has nearly one hundred and fifty customers and furnishes about fifty town lights. The charge made is \$15 per 1,000 cubic feet, which is considered the equivalent of coal gas at \$1.50 per 1,000. There are six miles of mains in the town, of which the largest is four inches in diameter. The total cost of the system, about \$10,000, ran up much higher than usual on account of a large amount of rock work that had to be done in building the house and laying the pipes. An ordinary municipal plant of this type, it is claimed, can be installed for \$4,000 to \$5,000.

Septic Tanks at Manchester, England

PROBABLY the largest amount of sewage treated in septic tanks at any one plant in England is the 43,350,000 gallons per day at Manchester, treated at the Davyhulme Sewage Works. This sewage first passes through screens and silt basins, then into open septic tanks, the effluent from which is further treated on bacteria beds, or else is allowed to settle and then is filtered rapidly. The sludge is carried by sludge boats through the Manchester and Liverpool Canal and out to sea, where it is dumped, as is London's sludge. There are 46 acres of contact beds, and about 27 of rapid filters (used for sewage greatly diluted with storm water). The sludge removed by sedimentation averaged 13.3 tons per 1,000,000 U. S. gallons; that removed from the septic tanks, 10 tons per 1,000,000 gallons. The contact beds were used at the average rate of 650,000 gallons per acre per day. One half-acre secondary bed was used for a part of the time at the average rate of about 1,000,000 gallons per acre per day, removing 65 per cent. of the albuminoid ammonia from the effluent of the other beds, or leaving but 10 per cent. of that in the crude sewage. The total cost of treatment for the year 1905-6 was \$5.76 per 1,000,000 U. S. gallons, or 15.5 cents per capita; the amount treated averaging 74 gallons per capita per day. Two other smaller plants receive a part of Manchester's sewage.

Low Lighting Rates for Mobile, Ala.

THE Electric Lighting Committee of Mobile, Ala., recommended to the Council, on October 31st, that a contract be awarded to the Machinery Sales Company of Cincinnati, O., on the terms proposed by them, viz.: that 450 or more enclosed arc lamps, 6.6 amperes and 72 volts at the arc, be furnished and lighted on an all-night schedule, for \$58 per lamp per annum; twelve markethouse lamps for a shorter period for \$53 a lamp; and to charge not to exceed 8 cents per kwh. for up to 50 kwh. per month, graded down to 4½ cents for between 500 and 1,000 kwh., with 10 per cent. discount for bills paid before the 15th. Also to pay the city 2½ per cent. of the gross revenue.

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Comparisons of Lighting Costs

ON another page of this number will be found a table showing a most complete statement concerning the costs of street lighting in eighty-four cities of the United States, which we believe will be of considerable interest to almost every city of the country. Probably the items which will

be examined by the greatest number are the prices, especially those of 2,000 c.p. lamps. It is noticed that these vary from \$47 to \$109.50, the greater being approximately two and one-third times the smaller; while only seven are within ten per cent. of the average price. It is evident from this either that most of the companies are making all kinds of profits, or that there are some very important items of expense which vary considerably in different localities. To a certain extent, both are true; but tables like this are too often assumed to demonstrate the former only. As a matter of fact, there are very important items of expense which vary greatly in different localities. The item of fuel is one of the most important of these. The last published reports of the U. S. Census Bureau covering this point show that in 815 electric lighting and power plants the cost of fuel formed on an average 27½ per cent. of the total expenses; also that the average cost of coal in Vermont was \$5.15 a ton, in Massachusetts \$4.21, in Ohio \$1.79, and in Pennsylvania \$1.54. Even allowing for difference in quality of coal used, it seems probable that New England pays at least twice as much per heat unit for its fuel as do the coal-producing States. This alone would account for more than 25 per cent. difference in cost. A rational determination of the reasonableness of charges for any given electric lights will take into account this and other differences in cost of production. When a comparison of cost of lighting by municipally operated plants, either with each other or with private plants, is attempted, the difficulty becomes greater. One city, for instance, places its plant on a piece of unoccupied land already owned by it, another must buy property for this purpose. In one sense the former may therefore obtain its lights at less cost than the latter, even though the other items are the same; but such a method of calculation destroys the value of the result for purposes of comparison, if the aim of the latter is to determine relative economy or efficiency of the plants.

If the cost of municipally furnished light is to be compared with the prices charged by private plants, the purpose of the comparison should be clearly understood. It is generally assumed that this purpose is to determine the relative economy of construction and maintenance. If this is the case, there should be charged against the city a correct value for every asset and for every service rendered for which a private plant would need to pay, whether or not the city actually makes any disbursement therefor; also such charges for sinking-fund or depreciation and the like, as are allowed for by the most conservatively managed private plants. But a city may in some cases have an asset which is of no value except as used in connection with municipal lighting, such as the privilege of placing wires in private ducts or on private poles; and if the comparison is made to determine the advisability of establishing a municipal lighting plant, then it would be perfectly justifiable to omit such service in the estimate of cost. Even then, however, it would be desirable to assign a value to this for use in other comparisons.

MUNICIPAL UNDERGROUND SYSTEMS

Losses Due to Street Opening—A Suggested Remedy—The Problem of Good Pavements—Conduits for Pipes

ONE of New York's most successful contractors made it a practice never to undertake sub-surface work in that city except on a percentage basis, on account of the great uncertainty as to what he would find under the paving—a subject about which he was probably better informed than any one city official or department. In a city of only 30,000 people the writer has found in one street cross-section three water mains, two gas mains, two sewers, a wire conduit and a steam-heating main, and few of even the smallest cities have not in their main streets at least a sewer, a water main and a gas main. Each of these is connected with practically all buildings in the center of the city. Each of these structures and each connection is placed in a separate trench, and each is laid, relaid and repaired to the permanent injury of the paving. This condition of affairs is well known by most city officials, but it is doubtful if all realize its enormous importance as probably the most difficult and imperative of municipal problems. In preparing a paper on "Losses in Underground Municipal Structures" some time ago, the writer estimated that the value of a pavement so disturbed is diminished thereby at least 30 per cent., this including shortened life and lessened serviceability, a loss of, say, 12.5 to 25 cents per lineal foot each year. Moreover, we can never have good pavements, no matter how much we spend on them, while this condition continues; nor can we keep our streets clean, nor avoid the inconvenience and annoyance caused by street openings, until some remedy is found.

The discouraging thing about the whole matter is the apparent acquiescence of both public and officials in these conditions, or a confining of the struggle against them to attempts at better patching of the pavements. Taking into account the loss in pavement value, the annoyance and dirt, the loss of trade to merchants in front of whose stores such improvements are constructed, and half of the millions now spent annually on street pavements might better be laid out in a really "permanent improvement" (as the best class of pavements is now facetiously called in many cities), which would give longer life and greater usefulness to such pavements as were built with the balance. Cities have almost learned the truth that the construction of a good pavement is more economical and satisfactory than continually patching the worn places in a poor one whose first cost is only half as great; they will some time find out that it is more economical and satisfactory to again double the first cost and thus obtain a pavement which need not be continually patched because of street openings, but may be worn to its natural finish.

A SUGGESTED REMEDY

We suggest the following as a possible means to the end of these undesirable conditions: Continue each curb down to a depth of, say, seven feet with a concrete wall. Paralleling this, say, four feet away, under the sidewalk,

place another such wall, the space between to be roofed over with a concrete or flag sidewalk. This conduit could contain all the pipes, etc., needed in a small city; in a large city the conduit would be much larger. The sewer could remain in the center of the street, but all probable house connections should then be built to the curb line before the pavement is laid. Such a conduit could easily be built for \$5 or \$6 a running foot, or \$10 to \$12 for the two per foot of street, from which should be deducted the cost of the curb and pavement which is included therein. An alternative to this construction would be a central conduit, from which a pipe of, say, 18 inches diameter would be run to each property in a straight line. In this would then be laid all house service pipes and wires, such pipes being connected up in the cellar or basement and pushed from there to the conduit. The cost of this would probably be somewhat less than that of the first suggestion.

Where basements or cellars are permitted under the sidewalks, the front walls of such could be used as one side of the conduit, and future permissions to build such basements could provide for the construction of such conduit by the owner in return therefor.

We realize the objections to this proposition, the most important of which is the difficulty of getting into the conduits the pipes which are already laid in the street. But a careful study of the question convinces us that this at least can be overcome more easily than at first thought seemed probable. The burden of cost would partly be met by rental collected from the various companies for the use of the conduit, which they should cheerfully pay, since each now pays out for street openings an average of 10 to 25 cents a year for each lineal foot of main on paved streets and a very appreciable part of the gas and water carried in pipes is lost through leaks which would be unnecessary when every joint was easily accessible.

Titles of Municipal Reports

We have before us a pamphlet entitled "Reports of, Engineer, Board of Public Works, and, Consulting Engineer to the Water Committee, 1906," nothing appearing on either cover or title page to indicate the city concerned. The report opens "Honorable Board of Public Works"; again no city. We glanced over the first twenty-one pages and could find nothing to indicate whence the report was sent, but on the twenty-second found the name of a city which was presumably the one publishing the report. If this were an exceptional case we would not mention it; but a very considerable percentage of the municipal reports reaching us show a similar omission; in fact, in a few cases we have been unable to find even by inference the name of the city to which the reports refer. We beg to respectfully call attention to this matter in behalf of ourselves and of others who have occasion to refer to municipal reports; and also in behalf of the cities themselves, for whom an attractive report serves as a valuable advertisement, but a slovenly one as a suggestion of equal remissness elsewhere.

MUNICIPAL WORK ON THE PACIFIC COAST

Report Before American Society of Municipal Improvements Shows Substantial Progress—Street Work and Sewerage in Far Western Cities—Water Works and Lighting Facilities—Garbage Disposal a Problem

MR. T. D. ALLIN, of Pasadena, Cal., a member of the Committee on Review of the American Society of Municipal Improvements, presented in his report at the recent convention a brief statement of the work done in a considerable number of the cities of the Pacific coast, those not included having failed to reply to his inquiries. The work referred to was performed during the year ending July 1, 1906. The various classes of street work are seen to have formed a large part of these improvements. All the cities did some grading; all laid some sidewalks, cement in all cases but one. Cement curbs and gutters also are seen to be the most popular kind. But four cities used any paving other than asphalt and macadam; but all the cities of southern California, except one, and three of the others, oiled their streets. The following data are taken from the report:

MONROVIA, CAL.

Water Works—Public.—Have estimates on improvements of waterworks in preparation. Improvements will cost from \$85,000 to \$100,000. Bonds will no doubt carry.
Lighting Plant—Private.—Lights installed, incandescent 160.

POMONA, CAL.

Water Works—Private.—Tunnel developing plant, cost \$2,400.
Lighting Plant—Private.—Lights installed, arc 40, incandescent 400.

SAN BERNARDINO, CAL.

Waterworks—Public.—One sixteen inch driven well, 1,066 feet deep; seven miles pipe line, 2 inch, 4 inch, 6 inch diameter; meters 25.
Lighting Plant—Private.—Lights installed, arc 21.

RIVERSIDE, CAL.

Water Works—Private.
Lighting Plant—Public.—Total lights now installed, arc 67, incandescent 32,199.
Garbage Disposal—Deposit.—Burn and bury on outside grounds.

SAN PEDRO, CAL.

Water Works—Public.—Began two and one-half years ago, with addition still being made.
Pumping Plant.—One million gallons, cost \$35,000; two wells, cost \$5,000; one covered reservoir, capacity two and one-half million gallons, cost \$10,000; pipe lines, 13 miles, cost \$60,000; meters 45, cost \$675.
Lighting Plant—Private.—Lights installed, arc 83; improvements last year, cost \$5,000; five and one-half miles sewer just begun; ten carloads crude oil for street work ordered.

ANAHEIM, CAL.

Water Works—Public.—One and one-half miles pipe line, cost \$1,263; forty-two meters, cost \$616.
Lighting Plant—Public.—Lights installed, incandescent 719.

OCEAN PARK, CAL.

Water Works—Private.
Lighting Plant—Private.—Lights installed, arc 5.
Garbage Disposal.—Plans for incinerator accepted; construction not yet begun.

SANTA BARBARA, CAL.

Water Works—One public, two private.—Two public reservoirs, one hundred and fifty million gallons capacity each; running tunnel, 20,000 feet through mountain to new source of public supply.
Lighting Plant—Two private.

FRESNO, CAL.

Water Works—Private.
Lighting Plant—Private.
Garbage Disposal.—Garbage hauled to yard beyond city limits and burned in pit; new pit dug with teams when old one fills with ashes, etc.
City Hall.—Under construction, cost \$75,000.
Sewer System.—Under construction, at cost of \$175,000, including sewer farm of 972 acres, costing \$30,000.
Oiled Streets.—Not successful for wearing surface, but successful for laying dust.

Tabulation of Street Improvements on the Pacific Coast, July 1, 1905, to July 1, 1906.

By T. D. ALLIN, Pasadena, Cal.

NAME	Miles of Street Grading	Miles of Cement Sidewalks	Miles of Curbing			Miles of Gutter		Sq. Yds. of Paving		Miles of Oiled Streets	Miles of Sewers		Sewer Flush Tanks	
			Cement	Granite	Wood	Cement	Cobble Stone	Asphalt	Macadam		Outfall	Lateral	Miller-Potter	Walker
Victoria, B. C.	0.70	10.00	0.20	0.20	.....	.....	.....	.....	33,000	.....	3.00	2.00	10	...
Reno, Nev.	3.00	4.09	0.25	0.45	.....	0.06	.....	27,432	16,427	.....	1.09	2.02	.....	.....
Oregon City, Ore.	0.08	0.16	0.16	.....	.....	0.16	.....	.....	2,000	.....	.....	.....	.....	.....
Portland, Ore.	7.70	.....	4.10	.....	4.80	.....	1.00	40,598	.....	.....	2.50	5.00	.....	.....
Chico, Cal.	0.50	0.25	0.25	.....	.....	0.50	.....	.....	10,461	.....	3.00	10.00	.....	30
Stockton, Cal.	11.00	3.00	0.25	.....	22.00	22.00	.....	1,202	100,000	0.25	.....	15.00	.....	50
Modesto, Cal.	1.00	0.60	0.30	.....	0.30	0.09	.....	.....	.....	0.08	.....	14.00	.....	.....
Fresno, Cal.	2.30	6.60	.....	.....	4.50	.....	.....	.....	.....	8.00	.....	1.10	.....	.....
<i>Southern California</i>														
Santa Barbara	1.10	.....	.....	.....	0.80	0.20	.....	1,550	.....	3.00	.....	3.00	3	.....
Ocean Park	8.40	17.00	17.00	.....	.....	.....	.....	41,000	.....	7.29	8.00	6.50	.....	.....
San Pedro	13.00	11.00	15.75	.....	.....	0.25	.....	1,500	.....	20.00	1.25	4.75	48	.....
Anaheim	5.00	2.00	2.25	.....	.....	.....	.....	.....	.....	1.00	.....	.....	.....	.....
Corona	2.50	3.50	7.10	.....	.....	1.30	5.50	.....	.....	3.80	.....	.....	.....	.....
Riverside	14.00	2.00	2.00	.....	.....	2.00	.....	1,550	1,250	25.00	.....	2.17	.....	.....
Redlands	5.00	2.00	.....	10.00	.....	10.00	.....	1,200	72,500	5.00	3.50	1.50	6	.....
San Bernardino	6.50	2.00	2.00	.....	.....	0.03	.....	.....	.....	12.00	2.25	.....	5	.....
Pomona	4.15	6.52	8.76	.....	.....	0.40	1.50	.....	.....	20.00	.....	.....	.....	.....
Monrovia	27.00	12.50	43.00	1.00	.....	1.50	1.50	.....	.....	22.00	.....	.....	.....	.....
Alhambra	6.00	12.50	12.50	.....	.....	12.50	.....	.....	.....	.....	.....	.....	.....	.....
South Pasadena	7.30	8.00	8.00	.....	.....	4.50	.....	.....	.....	20.00	.....	2.80	20	.....
Pasadena	22.00	30.00	38.00	.....	.....	38.00	.....	32,000	23,500	20.00	.....	.....	.....	.....
Los Angeles	40.00	75.00	80.00	.....	.....	.....	.....	.....	.....	35.00	7.00	14.00	50	.....

In addition, Victoria laid 7,150 square yards of wood block pavement; Oregon City, 25 square yards of brick pavement; Portland, 4.10 miles of stone sidewalks, 5.20 miles of wood sidewalks, 34,465 square yards of gravel street paving and 20,867 square yards of bitulithic pavement; Santa Barbara laid 2 miles of asphalt gutter and 1.50 miles of sandstone curbs; Riverside put in 13 sewer flush tanks other than Miller-Potter or Walker; Pomona laid 1.50 miles of cobblestone curb; Los Angeles laid 6 miles of asphalt, brick and macadam paving, and 30 miles of cement and cobblestone gutters, the amounts of each not being given.

MODESTO, CAL.

Water Works—Public.

Pumping Plant.—One and one-half million gallons capacity; wells, four; tanks, four; total capacity, 160,000 gallons; pipe lines, 13 miles; cost \$60,000.

Lighting Plant—Public.—Auxiliary to water plant; lights installed, incandescent 356.

Garbage Disposal.—The scavenger hauls the same to the city dumping ground on the outskirts of the city, where it is burned at frequent intervals.

STOCKTON, CAL.

Bond election proposed as follows:—Street improvements and repairs, \$250,000; City Hall, \$125,000; fire protection, \$60,000; storm water sewers, \$35,000; outfall sanitary sewer, \$10,000; children's play ground, \$25,000; Stockton harbor improvements, \$15,000; garbage destructor, \$20,000; electric lighting plant, \$160,000; total, \$700,000.

Ten miles street work proposed for the coming year.

CHICO, CAL.

Water Works—Private.

Lighting Plant—Private.

Street Improvement.—Work about to begin on one mile cement gutter and one mile of cement sidewalks. Other street and sanitary improvements to be commenced soon.

OTHER TOWNS IN CALIFORNIA AND OREGON

Several other towns report no new improvement during the year, only repairs having been made on improvements made, such as water, sewers and streets.

CORVALLIS, ORE.

Water Works—Public.—One reservoir, 300,000 gallons capacity, cost \$3,000.

City has just completed Gravity Water System with fourteen miles conduit and fourteen miles of distributing system. Source of supply located in the coast mountains. Pipe line capacity, one million gallons, with seventy-five pounds pressure.

Lighting Plant—Private.

OREGON CITY, ORE.

Water Works—Public.—Pipe lines, one and one-half miles, cost \$8,000.

Lighting Plant—Private.—Lights installed, arc 22.

Garbage Disposal.—All garbage hauled to a vacant tract outside of city and burned.

HIGHWAY CONSTRUCTION

National Aid of Paramount Importance—Good Roads Would Lessen Cost of Living—Obstacles to Improvements

By WILLIAM W. TODD,
Mayor of Jackson, Mich.

NATIONAL aid to highway construction as a plain, practical business proposition is, in my opinion, paramount to any question that now presents itself, or that can possibly be suggested, because good roads would do more for the country than any other one thing that can be named, or any dozen or more things combined. The question is outside of and above all party politics, its entire constitutionality is now almost universally admitted, and the necessity for it is present in every household in the land. It is important to every calling and condition; to every trade and profession; to every toiler in whatever field of human endeavor; to every manufacturing interest and industrial concern; to every church and school, and to the stability of the Government itself.

The rural church-house is the birthplace of Christian character, of high ideals of life, and of patriotic purpose, but neither rural church nor school can flourish where impassable roads abound, and if these cannot prosper the American home cannot long survive. The American home can only be perpetuated in its present glory through the uninterrupted progress of civilization, the wholesome growth of Christianity, and the spread of education in the land.

If the common roads of the country were brought to a condition that would enable farmers to market their products at all seasons of the year, the cost of living in town and city would be greatly lessened, and discontent among laboring people and the operatives of industrial concerns would largely decrease, if it did not entirely disappear. Why and how are the two questions which must be answered.

CAUSES OF DISCONTENT

Present road conditions compel farmers to rush their products to market as soon as harvested, when the roads are at their best, since by waiting a convenient time they may not get there at all because of bad roads. This naturally congests the market, forcing low prices, to the great detriment of the producer and without appreciable benefit to the consumer, because the average family in town or city buys only in small quantity at one time, say a day's or a week's supply. What is the result? The speculator, finding prices low and knowing that in a little while the bad roads' season will be on, when competing products will be kept from the trade centers, buys up the surplus and stores it away for the day of necessity, when he can demand and receive his own price for his holdings—the stuff for which men toil, which they are compelled to have at whatever cost. And when the citizen in towns—the mechanic and operative of shops and factory—is forced in winter and spring to pay exorbitant prices for those articles of household necessity which went begging for buyers at low prices the preceding fall, he figures the increased cost of living in comparison, and grows restless and discontented. Now, on this point I claim that the resident of the city is the gainer by good roads just as much as the farmer.

The present obstacle in securing interest in good roads lies in the fact that our State and county taxes have increased without any apparent benefit, and on this point it cannot be denied that our governments, State, county, and municipal, must be run more economically, and in the interest of the people, if the people are to have any confidence whatever in local improvements. I have yet to hear of the first person that has objected to good roads, but there has been considerable opposition to the way in which they are built.

The Watertown Society of Engineers

THIS Society was organized in March of this year, with a membership of about forty, which has increased to about sixty at the present time. Meetings are held the first Monday of each month, except June to September, inclusive. The first number of their proceedings has just been issued, containing a paper on "Water Power of the Black River," by Frank A. Hinds, with considerable discussion. The constitution, officers and list of members also are given. The officers are Frank A. Hinds, President; S. F. Baggett and D. D. Kieff, Vice Presidents; Geo. E. Willcomb, Secretary; and Henry E. Baker, Treasurer. The membership includes civil, mechanical, electrical and heating engineers, architects and chemists.

DETROIT'S STREET RAILWAYS

The Relations Between the City and the Companies—History of the Controversy—New Franchise Agreed Upon by Company and Mayor—Terms of the Compact

Abstract of a paper by R. K. DAVIS, Detroit, read before the American Society of Municipal Improvements

IN view of the vote taken by Detroit, Mich., in the November election, on the question of street railway franchises, a comprehensive description of the present condition and the events and discussions leading thereto, of which a synopsis is herewith given, are especially timely.

In 1891, when the Detroit street railways were still operated by horse power, a strike of the operatives for higher wages engendered bitter feelings between the railway company and the citizens, which continued after the settlement of the strike. The late Governor Pingree, then Mayor of Detroit, contended that an extension of the railway franchises to 1909, which had been granted in 1879, was defective, and that the franchises had already expired; but after extended litigation the court of last resort decided otherwise. The Mayor and his associates then endeavored to secure a three-cent fare, which was afterward modified to eight tickets for a quarter. Failing in this, they attempted to arrange with capitalists for the purchase of the franchises and the adoption of lower rates, but were unsuccessful.

The city of Detroit is laid out with diagonal streets radiating from the business center in all directions, combined with the ordinary rectangular system. These radial streets were all occupied by the railway company, which charged five cents on each line leading to the center, and therefore ten cents to cross the city. When the company adopted electric power, however, separate lines were combined in pairs, making continuous routes across the city through the center, on which one fare only was charged; certain transfer concessions also were allowed voluntarily; but the public was still unsatisfied.

FRANCHISE TO NEW COMPANY

In 1895 Messrs. Everett and Moore procured a franchise from the city covering about 60 miles of streets in the rectangular system, and built lines which, while they could not give the most direct approach to the business center, reached portions of the city which the other system did not. Tickets sold eight for a quarter were accepted from five in the morning until eight at night, and others, sold six for a quarter, during the night-time. The other company was then selling tickets eight for a quarter, accepted only during one hour in the morning and one in the evening. In 1900 the two companies were merged into the Detroit United Railway Company, but no change was made in the fares; and at present there are 60 miles of railway operated under the eight-for-a-quarter system and 127 miles under the other, with no transfers except to such as pay a five-cent fare, and this a matter of concession and not of right.

The original first company is required to pay an annual

tax of 2 per cent. on its gross receipts, ordinary city taxes on real estate, and State taxes; also to construct the pavements between the tracks. The second company pays no tax on gross receipts and does not construct or maintain any paving, which it is estimated would amount to about \$16,000 a year for taxes and \$60,000 for paving. The franchise of the second company expires December 4th, 1924; the franchises of the first company on most of the down-town streets expire in 1909, but many of those on outlying streets do not, thus preventing a full acquirement in 1909 of any comprehensive system. The present company, owner of all the franchises, has meanwhile rebuilt the entire system, which is well equipped, and a most excellent service maintained. Mayor Marbury, successor to Mayor Pingree, and his successor, Geo. P. Codd, have endeavored to maintain amicable relations between the city and the railway company, without, however, granting undue favors to the latter. A series of conferences, covering nearly a year, has recently resulted in the proposal of a new franchise, the terms of which are approved by both Mayor and company, as representing a final solution of the street railway question.

TERMS OF PROPOSED NEW FRANCHISE

The terms are, that all of the franchises of the various lines, some of which expire in 1909, others in 1912, others in 1915, and some others between that date and 1924, shall be extended to the date upon which the franchise rights of the Detroit Railway, or eight for a quarter system, will expire under the terms of its ordinance, viz: December 4th, 1924; and that in consideration of the continued permission to do business, the railway company shall accept the following conditions of operation: That for five hours of each day, viz., from five until eight o'clock in the morning, and from half past four until half past six in the afternoon, an industrial ticket fare shall be placed in operation at the rate of 10 tickets for 25 cents, or $2\frac{1}{2}$ cents per industrial ticket. That during the remaining hours of the day, a six-for-a-quarter ticket shall be accepted for fare. The single cash fare rate of 5 cents, which seems to be standard upon all street railways of the country, remains. These fares are to apply to all the lines, and a system of universal transfers from line to line shall be put into operation and maintained. Upon the gross receipts of the entire system, the street railway company shall be required to pay a tax of 2 per cent. per annum into the city treasury as a franchise tax. As to public duties with regard to streets, the railway company shall be required to make and maintain foundations and pavements lying between

its tracks and to maintain all pavements for 12 inches outside its tracks.

CITY MAY PURCHASE SYSTEM

Furthermore, as the franchises will expire at a uniform date, viz: December 4th, 1924, and as upon that date no municipal ownership proposition which might be suggested could be enforced as against the entire street railway system of the city, if that were at any time thought desirable, provisions have been made for the purchase by the city, at the expiration of the period of the franchises now granted, of the entire new system, upon an arbitration value to be determined by a commission, a portion of which shall be appointed by the street railway proprietors, a portion by the city, and another portion by the local Chancery Court. The arbitrated value shall be the purchase price of the property, and in arriving at it, no account shall be taken of the value of franchises or of the good will of the business. The arbitrators will be required to determine, as between the city and the railway company, the value of the property then in existence and capable of being taken over by the city as a going concern.

It might be added that the new franchise provides for the immediate construction of 23 miles of additional track within the City of Detroit and for the construction from time to time hereafter, as the Common Council may direct, of additional routes, the rights to all of which, under the terms of the new ordinance, will expire at the same time as all of the rest of the property, thus enabling the city, at their expiration, to come into the possession of every yard of street railway track within the city, if such a process shall be deemed desirable. Ample reservations of police power and of the right to regulate the operation of cars, alter routes, etc., are reserved to the Common Council.

The proposition has been the subject of discussion by all citizens, and practically every member of the city government pledged himself to submit the subject to the people's vote; which is of no legal effect, but by which all have agreed to be governed regardless of their individual opinions. The leading business men of the city, organized into a Citizens' Committee, have audited the books of the street railway company and determined for themselves the cost of carrying passengers, what they think it should be, and the capital investment necessary to reproduce the properties; and are in favor of the ordinance. The company freely offered access to its books, and has taken pains to inform the public concerning its affairs. The result of the vote will probably be known to our readers a few hours before this article reaches them.

Three-Cent Fares in Cleveland.

NOVEMBER 1st was Mayor Tom Johnson's jubilee. He served that day as motorman on the first 3-cent-fare street car ever run in Cleveland, when the Forest City Railway Company formally opened its west-side line. J. V. McGorrey, Democratic candidate for Sheriff, officiated as conductor, and the car traveled the entire length of the line. Mrs. Johnson rode in the vestibule of the car with the Mayor.

GAS PRICES AND PRESSURES

A Reply to Alton D. Adams's Article in Municipal Journal and Engineer of October 24th— Conditions in Duluth, Minn.

By L. N. CASE

Manager and Secretary, Duluth Water and Light Commission

IT is true that the trend of the times in gas supply is decidedly toward small mains and high pressures.

The installation of small mains is most certainly in the interest of consumers, as the rates they pay are gauged to cover all expenses, operation, maintenance and interest. Any act that tends to reduce either one or all of the expenses redounds to the benefit of consumers, whether in a municipal plant or in that of a private company. In order, however, to make this saving in the cost of construction, higher pressures must be maintained, but, I hold, not necessarily to result in increased consumption.

Modern appliances both of lamps and stoves have attachments that regulate the quantity of gas in a mixture with air, and these appliances when installed by the company or department are regulated to produce the best efficiency with the pressure at, or in, the locality in which they are installed.

Our experiences in Duluth have been contrary to the statement made by Mr. Adams that increased pressures produce an increase in the bills of the consumers. For the first three or four years of my management we maintained a pressure *at the office*, which is in the center of the city, of from 24 to 30 tenths. The rapid increase in the consumption of gas made it necessary to do one of two things: either reinforce with parallel lines the present mains, or increase the pressures. We chose the latter, and are now carrying at the office an average of 45 tenths, and have not as yet, after two years' experience, had any evidence that this increased pressure affected the bills in any way. We found it necessary, however, to re-regulate the appliances, but this was a small expense. It is true that a reduction of rates always increases the consumption, but no more so than with every other commodity of life.

The statement that the discharge from *defective* pipes and fixtures is increased with the increase of pressures, is true; and to that extent, if allowed to continue, will increase the bills; but they are not allowed to continue. The horrible smell that fills the premises from a leak no larger than a pin hole, leaves no alternative but to have the hole stopped up.

Our situation in Duluth is peculiar. Five blocks back from Superior street, our main business thoroughfare, and which lies parallel to and near the lake and bay, the elevation is increased 250 feet. The gas pressures in this elevated locality are of course considerably higher than in the lower levels. Were it true that an increase of pressures has a like effect on the bills, I think we would have found that out ere this. People as a rule will not stand that kind of business, and kicks would be numerous, whereas we have had absolutely none.

SOME STREET LIGHTING STATISTICS

IN the following table are presented statistics covering street lighting in all cities of the United States of more than 25,000 population, compiled from data collected by the U. S. Bureau of Labor for the year 1903, the latest which have been published. For each group of cities are given the total number of electric arc lights, the number of arc lights divided by the mileage of paved streets, the total number of all lights, including electric arcs, and this last divided by the miles of paved streets and by the miles of all streets, paved and unpaved.

These divisions were made under the assumption, first, that the electric arc lights were placed on all paved streets and on these only; second, that no lights were placed on any but paved streets; and third that lights were distributed over all streets. Undoubtedly none of these assumptions is correct; but it is believed to be almost

impossible to obtain sufficiently detailed information to permit of more exact ones. There is considerable inaccuracy in the first assumption for the first class, because Chicago has several thousand gas lights on her paved streets; as has New York also, but to a much less degree. Probably the second assumption is the least accurate of the three. It would appear that the largest cities are much the best lighted, as is indeed the case; and that the intensity of lighting decreases with the size of the city. These are, of course, averages only. In any one class certain cities have five or more times as many lights per mile as certain others of the same class.

The total payments for street lighting in 1904 were as follows: By cities of 300,000 population and over, \$1.17 per capita; by those of 100,000 to 300,000 population, \$0.82 per capita; by those of 50,000 to 100,000, \$0.71 per capita; and by those of 30,000 to 50,000, \$0.67 per capita.

NUMBER OF LIGHTS IN CITIES OF VARIOUS SIZES

POPULATION OF CITIES	ELECTRIC ARC LIGHTS		ALL LIGHTS		
	Total	Per Mile of Paved Streets	Total	Per Mile of Paved Streets	Per Mile of All Streets
More than 300,000	54,859	6.40	238,872	27.87	15.47
From 100,000 to 300,000	27,552	8.90	69,310	22.38	8.00
From 50,000 to 100,000	20,590	7.24	44,348	15.61	7.29
From 25,000 to 50,000	25,691	7.46	43,023	12.49	3.84

COST OF MUNICIPAL LIGHTING AT CHICAGO

IN the annual report for 1905, the Department of Electricity, of Chicago, states that the cost of furnishing electric arc lights for that year, "including their proportion of office charges, but not including interest, depreciation, taxes or insurance, has been \$52.14 per lamp." A new station started in operation with modern equipment in March, and is at present lighting 1,388 lamps. "The capitalization of this plant is \$255,340, including building, stack, conduits, circuits, engines, boilers, stokers, condenser system, super-heaters, steam piping, crane, lamps and other electrical apparatus. The cost per lamp is \$38.70 including all operating charges, but not interest, depreciation, taxes, and insurance; "but if as a theoretical charge there are added, say interest and depreciation at 8 per cent., taxes at 1 per cent, and insurance on the building at \$110 a year, the total cost per lamp per year would amount to \$55.34." This last is certainly a good showing; although the allowances are smaller than are generally considered proper. The New York Commission estimated 6 per cent. depreciation, and Chicago's 4 per cent. bonds sell at par; a total of 2 per cent. more than the above, about \$5,100 in all, or \$3.68 per lamp; making the cost \$59.02 per lamp for the new (H. N. May) plant. If the same rates were applied to the entire city plant, the cost per lamp would be about \$82.33; and if an additional allowance were made for the water supplied by the city and for poles of private companies used without charge,

this would become about \$84.40. We believe these latter rates are the ones which should be used in comparison with those paid to private companies by this or other municipalities.

CEMENT COMBINATION

THE Geographical Survey in a bulletin states that there is a noticeable concentration of interests in the cement industry, and that this probably will become marked year by year. The 88 plants in existence in 1905 were owned by 78 companies and several of these nominally independent companies are closely connected by ownership. But it is stated that good raw materials are so widely distributed in the United States that there is hardly a county which could not produce Portland cement if prices were forced high enough. The only limitation now on the erection of cement plants is the fact that the great cost makes the venture prohibitive for the individual or for the small firm. The cement industry is at present in a more concentrated condition than was the iron and steel industry at the date of the formation of the United States Steel Corporation. The total authorized capital of all the American Portland cement companies now in operation will fall between the limits of \$110,000,000 and \$125,000,000. The bulletin states that this capitalization can not be considered excessive in view of the fact that it would cost probably from \$75,000,000 to \$85,000,000 to replace the plants now in existence.

THE DISPOSAL OF MUNICIPAL WASTE

Systems and Methods, with Special Reference to American Conditions—Reports on Operating Plants at Pittsburg, Norfolk, Atlantic City and Elsewhere

By W. F. MORSE, Sanitary Engineer

This Series of articles, begun in the February number, will be continued until completed and will be illustrated by original drawings, cuts, diagrams and pictures, and contain many tables valuable for reference.

The Subjects Already Treated by the Author Are:—

1. The Waste Collection Service in American Towns; Methods and Results.
2. Definition of Terms; Quantities; Proportions; Character of Waste in General.
3. Garbage; Analysis; Proportions; Values.
4. Dry Refuse and Rubbish; Quantities and Treatment.
5. Classification:—Commercial Values after Recovery.
6. The Refuse Utilization Stations in New York, Boston, Buffalo, and Brooklyn (illustrated).
7. Municipal Ashes; Analysis; Proportions; Values when Separated.
8. Ashes from Cremation of Garbage; Analysis and Values; Comparative Table.
9. Comparison of Ashes from English and American Cities; Cremation Means.
10. The Utilization of Municipal Waste in General; English and American Methods.
11. Commercial Values of Refuse and Ashes when Marketed and Manufactured.
12. The Analysis of Garbage; Tankage, Its Value (Special Tables).
13. The Garbage Disposal Plant, Cleveland, Ohio.
14. Street Sweepings; Fertilizing Value and Treatment.
15. Comparative Commercial Values of Waste.
16. Foreign Destructor: Special Chapter by an Eminent Authority.
17. The First Garbage Cremators.

The Following Are to Appear:—

18. Official Reports on Cremators.
19. Apparatus and Furnaces; Record of Work (illustrated).
20. Types of Furnaces; Their Employment; Municipal, Institutional, Industrial, Medical, Laboratory (fully illustrated).
21. Caloric Value of Waste as Fuel (comparative table).
22. Reduction and Extraction Process Described and Illustrated; the Earlier and Later Methods.
23. American Methods; Col. Waring and His Successors.
24. Present Situation in This Country; Résumé.
25. Means for Improvement as Suggested by Several Investigators.
26. What May Be Expected of the Future.

WORK OF THE ENGLE GARBAGE CREMATOR, NORFOLK, VA.

The following data are taken from the report of W. T. Brooke, City Engineer, 1893 to 1902. The year 1896, when the cremator was operated by the contractor, is omitted.

Total loads mixed garbage and refuse, 58,793.

Expenses of operation and maintenance:

Labor	\$16,735.64
Fuel (coal)	9,237.31
Repairs and sundries	3,263.39

Total expenses \$29,236.34

The collection is done by city teams, the carts holding forty-one cubic feet and averaging over one ton to a load. Assuming the quantity to be 60,000 tons for the period, this would give fifty cents per ton as the cost of operating, including also maintenance. During this time two steel chimneys have been supplied, and the furnace has been completely relined once, beside usual repairs to grates, etc. For the past four years, 1902-1906, the quantity of waste has increased, because of nearly doubled population of the city; and the cremator is now too small for the work demanded. The cremator has been under the charge of one superintendent for twelve years; two assist-

ants are employed in summer, one in winter season. This record of continuous successful service at low cost probably has not been equaled by any crematory of the American type.

WORK OF THE ENGLE GARBAGE CREMATOR, RICHMOND, VA., 1893 TO 1906.

The official reports of this city show the continuous disposal of garbage, market refuse, rubbish and the smaller animals for a period of thirteen years by the Engle Cremator, built under the superintendence of the writer, in 1893. The quantities of waste destroyed can be estimated from the detailed yearly reports of loads of garbage, market refuse and miscellaneous matter consumed. This approximates 6,182 tons per annum of mixed garbage, refuse and animals, but includes no nightsoil, street sweepings or ashes. The cost for operating expenses and repairs (which includes the addition of ten feet to the cremator, raising the brick stack twenty feet and complete relining of furnace), was 68 to 70 cents per ton of waste destroyed. At this time all the garbage is destroyed without difficulty, and the cremator seems likely to fulfill its purpose for some years to come. It has been under the charge of one superintendent, Mr. W. P. Belton, for the past twelve years.

These cremators of the improved Engle type (Warner patent) at Richmond and Norfolk, have, with the exception of the furnace at Wheeling, W. Va., probably been in continuous use longer than any other of the American garbage furnaces. The first cost was small, about \$7,500 each; the repairs and extensions have not changed the original designs, and there has been no serious complaint or stoppage on the score of nuisance, though both are located in close proximity to dwellings. In these two cities the growth of population and increase in quantities of garbage has made these furnaces too small for present demands.

RIDER CREMATORS AT PITTSBURG AND ALLEGHENY, PA.

One of the earliest forms of crematories in this country was the *Rider Garbage Cremator*, built at Allegheny and Pittsburg, Pa. Mr. Crosby Gray, then chief clerk of Department of Health, Pittsburg, reported upon these furnaces, at the meeting of the American Public Health Association, in 1891, as follows:

In March, 1887, the Health Department of Pittsburg contracted with the Rider Garbage Furnace Company for an experimental plant, at a cost of \$3,000, which was completed the following autumn. This furnace followed the general construction of the "Beehive" destructor, of Burnly, England.

It was a plain brick rectangular box, with one horizontal set of grates, the main firing chamber being divided by a heavy bridge wall, over which the flames passed from the front to the rear. It was charged through ten small openings on top, the waste falling on the grates in small conical piles, the shape of a beehive, hence its name. The front section was fired with natural gas, and the heat generated was sufficient for combustion in the second compartment. The ashes were removed through doors on the grate level.

During 1889 an attempt was made to record the quantities destroyed, reported at 23,400 cubic yards of garbage only, equivalent to 9,384 tons, an average of seventy-five yards daily. The operating cost was 36 cents per yard, or about 90 cents per ton. The work was done without offense to sight or smell. The number of men employed was six. The method of receiving the waste and charging was defective, and the whole operation very expensive.

The Rider Garbage Crematory, at Allegheny City, built in 1885-6, was of the same construction. The cost of the plant was \$5,700—its capacity thirty tons daily, operating with two men and using the cheapest slack coal as fuel. The expense of operating was \$150 per month. Both of these furnaces continued in use for some five or six years, but were then abandoned. No other examples of the Rider Crematory were ever built.

THE SMITH-SIEMANS CREMATOR, ATLANTIC CITY, N. J.

In 1902 Mr. J. T. Fetherston, engineer in charge of street cleaning service, Borough of Richmond, New York City, made a report upon the construction and operation of the Smith-Siemans garbage furnace at Atlantic City, N. J., which included some features of interest. The period reported was from September 1, 1901, to September 1, 1902.

ANALYSIS OF GARBAGE, AUGUST, 1902

96 lbs. vegetable and fine animal matter.....	64 per cent.
19 " meat, fish and bones	12 " "
12 " oyster shells, crockery, tins (noncombustible)	8 " "
15 " free water drawn off before analysis.....	10 " "
9 " water lost in making analysis.....	6 " "

100 " "

Tons of garbage burned yearly.....	9,663 tons
Cost of labor and repairs	\$14,698
Cost per ton of garbage burned.....	\$1.52
Total amount of coal used.....	1,728 tons
Garbage burned per ton steam coal.....	5.6 "
Tons of gas coal used.....	1,298 "
Garbage burned per ton of gas coal	7.4 "

COST OF SERVICE FOR TWO YEARS, 1900-1902

Average cost for two years of garbage burned.....	\$1.48½ per ton
Garbage burned per ton of coal (total) 2 years....	6.15 tons
Garbage burned per ton of gas coal (total) 2 years..	7.70 tons
1900—Total amount collected, 10,477 tons; cost, \$11,594	
1901—Total amount collected, 9,663 tons; cost, 12,931	

Totals..... 20,142 tons; cost, \$24,525

Average cost of collection, \$1.22 per ton.

Average haul, 2 miles; cost per ton mile, 61 cents.

Weight of garbage per cubic yard, 1,560 lbs.

This Smith-Siemans plant was operated by producer gas generated at the plant and employed only in this work.

This disposal plant was greatly damaged in the great storm of October, 1903, and the following year was replaced by a reduction system, operating under the Arnold process.

One other disposal plant, of the *Smith-Siemans* type was built at Washington, D. C., but for some reason not made public was never put into commission.

REPORT ON DAVIS CREMATORY, TRENTON, N. J., BY RUDOLPH HERING, C.E., AUGUST 4-9, 1902*

Garbage unmixed with ashes, in following proportions:

Moisture	81 per cent.=1,620 lbs.
Garbage	15 per cent.= 300 "
Refuse	4 per cent.= 80 "
	100 per cent.=2,000 "

Total garbage burned

Total coal for main and auxiliary fires.....

Total garbage burned per ton of coal.....

Approximate average hours per day

Equivalent number of days 24 hours

Garbage burned per square foot of grate surface
per day of 24 hours

Garbage burned per square foot of grate surface
per hour

Garbage burned per cell, 25 square feet, per day of
24 hours

Percentage moisture in garbage

Corresponding water evaporated daily

Coal required to evaporate this water on basis of 10
lbs. water per lb. coal

Range of temperature of flue gases 600° to 1,000° Fah.

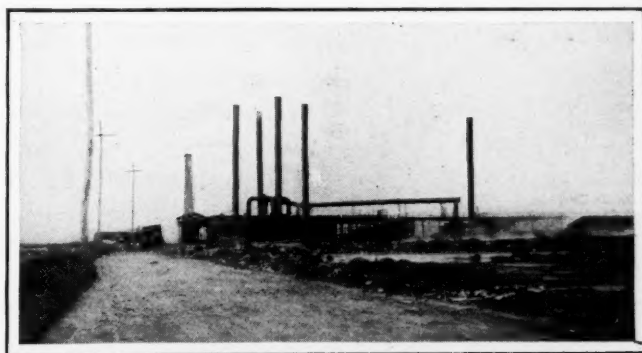
Total daily capacity (24 hours)

The report does not include the cost of labor and fuel, but this was unofficially reported at about 62 cents per ton.

This report of an engineer, who had previously made investigations on this subject in Great Britain and Germany, was, as stated by *Engineering News*, "the first thoroughgoing engineering investigation of the operations of the American garbage crematories of which we have knowledge."

It was undertaken under instructions of a Committee of the City Council, "appointed to investigate the workings of the city crematory, against which numerous complaints had been made," and a brief synopsis of the subject matter and the conclusions reached will be of value.

* *Engineering News*, New York, Sept. 11, 1902.



GARBAGE CREMATORY, ATLANTIC CITY, N. J.—GENERAL VIEW—1901

The garbage proper, or house refuse, is not of a combustible nature, containing much fruit and being almost saturated with water. The garbage from stores, markets, etc., is collected by private parties, and much of it is very combustible, such as paper, rags, straw, wooden boxes, barrels, etc.

The sources of the trouble were:

(1) *The odors arising from the garbage* when collected by the city teams and delivered at the works. This may be abated by exercise of more care in loading and better regulations at the furnace.

(2) *Odors from ashes after burning.* These arise from piles of ashes containing unburned animal and vegetable refuse and occur because of the furnaces not being competent to thoroughly consume the waste, and also because of the unskillfulness of the attendants.

(3) *The dust escaping from the chimney.* This is due to the faulty design of plan or to improper manipulation of dampers, or both, and can be avoided by the construction of a dust chamber between the furnace and the stack, and by adding properly designed dampers.

(4) *Unburned particles escaping from the chimney.* This is annoying because of their charry or greasy nature, and dangerous because of the burning particles setting fire to roofs. Unburned particles were noticed at a distance of one-quarter, one-third and one-half miles, varying from one-quarter to three-quarters of an inch square. The cause was incomplete combustion and the remedy was a dust-collecting chamber, and dampers to be closed when charging.

(5) *Odors from the stack.* This is usually the most serious trouble from garbage cremation and due largely to the design of the furnace. A discussion of this question involves (a) the character of the material delivered for cremation and (b) the essential parts of the furnace to obtain complete combustion. (a) The burning of garbage depends upon the amount of combustible it contains and the amount of dust, chiefly of an incombustible nature, which obstructs the free access of air, and also the amount of moisture present.

"In European cities, where the garbage and rubbish is mixed with ashes, the combustible matters are sufficient in properly constructed furnaces to burn the whole without the addition of fuel. In our own country it has become the custom to separate the ashes and garbage, and the burning becomes a more difficult matter, and can only be done by adding fuel."

FUEL VALUE OF GARBAGE

The combustible value of garbage alone is thus stated: "Taking 31 tons per day, with 81 per cent. of moisture, there would be present 21 tons of water. Assuming that all this water must be evaporated in the furnace, and taking 10 pounds of water evaporated by one pound of coal, it would require 2.4 tons of coal to drive off this water. Again, assuming that 20 per cent. of solid material in the garbage will yield roughly six tons of dry combustible material of about equivalent value of one-third that of coal, this is equal to 2.0 tons of coal, thus leaving an average of 0.4 tons of fuel which must be added daily to consume the garbage with its present quantity of moisture.

"The amount of coal actually used per day was 2.3 tons, and it is clear that the arrangement of the furnace or that the manner in which it is operated is not economical. The British cell destructor, with its sloping, drying hearth, the

sloping fire grates with forced draft beneath, the combustion chamber for mixing the gases before passing to the steam boiler and the dampers for regulating the draft, is more efficient than the American crematory, with its large areas of horizontal grate, resulting in piling up the garbage in heaps, requiring laborious and careful stoking to distribute the material, and compels a slower combustion of a larger surface of exposed matter and the need of some secondary fire for destroying odors."

The brick chimney (120 feet high) of this crematory, collapsed on September 17, 1906, and in its fall damaged an adjoining house, injuring an inmate. A special committee of investigation, appointed by the City Council, reported October 2, 1906, that it "believed the wreck of the chimney was due to an explosion at the base of the stack." The chimney will be replaced by one 150 feet high, of the radial brick construction, at a cost of \$4,500, in the near future.

CRITICISMS AND FACTS

The difficulties summarized in this report are common in a greater or less degree to all furnaces built in this country for the disposal of municipal waste. They are, in fact, common to all constructions of this sort throughout all the world, but are more pronounced and evident in those of poor design and unskillful operation, and less obvious in those of more scientific plan and more careful handling. The several types of American crematories have all, at one time or another, been the subject of severely unfavorable criticism, and complaints on some of the very points instanced by Mr. Hering, and while the distinction between the two types of construction is sharply drawn, it is certain that the record of work in the past twenty years fully corroborates and emphasizes the truth of these observations.

THACKERAY INCINERATOR, MONTREAL, CANADA, 1894

In 1894 Mr. Charles Thackeray built for Montreal, Canada, an incinerator of the English type, following closely the designs of the "Freyer" destructor at Manchester, Eng. (1886), but with modifications and additions made by the inventor. The contract called for the disposal of 150 tons per day,—24 hours,—at a cost not to exceed 90 cents per hour, equivalent to 14.4 cents per ton. Three City Engineers, Messrs. St. George, Doré and Champagne, made the official test of six days' run in November, 1894, as follows:

Total amount consumed, six days.....	811½ tons
Amount called for by contract, according to the number of cells in use.....	700 tons
Excess above contract.....	111½ tons
Average daily amount for six days.....	173.9 tons
Cost for operating, per day.....	\$27.60
Cost, per ton.....	\$ 0.15¾
Grate area.....	30 sq. ft.
Amount consumed per cell per day.....	14½ tons
Amount per cell per hour per square foot grate.....	40.27 lbs.
Amount per square foot of grate per hour.....	13.4 lbs.
Number of cells in plant.....	12

No analysis of garbage is given, but this is stated in the pamphlets of the company (1893) to be ashes, garbage, tins, crocks, vegetable and animal matter collected

together. All was burned without fuel. The chimney was 180 feet high and 7 feet internal diameter. Natural draft was used. The approximate cost of the plant was \$50,000.

MONTREAL—REPORT OF DR. PELLETIER, 1902

In 1902 Dr. E. Pelletier, Secretary, Superior Board of Health, Province of Quebec, made a report upon Refuse Disposal which includes additional facts respecting the Thackeray Incinerator.*

His analysis of Household Refuse is:

	In summer	In winter
Kitchen wastes.....	65	25
Paper (combustibles).....	15	10
Tins, bottles, rags, etc.....	10	5
Ashes	10	60
	100%	100%

The collection is made in a mixed or unseparated state by the city's wagons. Only the refuse of the West District is burned; that of the two other districts (East and Central) is tipped. The incinerator had the same number of cells as when constructed, but had been somewhat simplified by the removal or non-use of steam jets and mechanical fans for forced draft, the steam boiler removed from the main flue, the lower horizontal flue being discontinued, also the fourteen small supplementary cells, and the fume cremator at the base of the stack. There was added a screen or ash separator for removal of fine ash in winter season, as the large amount of fine particles interfered with the combustion of other matter.

From personal inspection Dr. Pelletier found that the household refuse of Montreal is auto-combustible during the summer, when the amount of ashes is 10 to 15 per cent. Mr. Doré, the Sanitary Engineer of the city, estimates the moisture of Montreal garbage and refuse to be 60 per cent.

The cost of incineration at Montreal, as stated by Dr. Pelletier, follows:

"From figures furnished by the Department in charge, the quantity of household refuse during 1901 was 17,445 loads, equivalent to 13,659 tons, destroyed at a cost of 93½ cents per ton. However, this does not give an exact idea of the cost of incineration, either on account of interruptions in the running of the incinerator (repairs or an insufficient amount of garbage), the wages of the men continuing to run just the same, or for other reasons. It is now well established that the net cost for the incineration of a ton of garbage is 39 cents per ton (note).

Note.—It is understood this is operating cost only, not including interest charges on capital cost or depreciation. In addition to the ash separator, a picking belt for recovery of marketable refuse is also employed, but the power is not obtained from the incinerator to operate the screen and conveyor.—(Ed.)

I did not on any of my visits detect any bad smell resulting from incineration, and every one I have spoken to about the matter has always answered that they never heard any complaints."

THE THACKERAY INCINERATOR SAN FRANCISCO, CAL., 1897-8

Following the installation at Montreal, four years later, a private company, *The Sanitary Reduction Company*, of San Francisco, Cal., bought the rights to build a Thackeray incinerator and acquired from the city a franchise for the disposal of its wastes for the term of fifty years.

This private company is the successor of two others

* Amer. Pub. Health Ass'n, Vol XXVIII—1902.

organized for this work, and has encountered many difficulties in the prosecution of its work. The incinerating plant erected in 1897 continued up to April, 1906, when it was partly destroyed by earthquake.

From a report made to the *Engineering News*, May 17, 1900, the following facts are condensed:

Number of cells.....	32
Daily capacity, each 45 yards or.....	20 tons
Total rated capacity of plant.....	1,500 yards
Equivalent in weight.....	600 tons
Square feet grate surface per cell.....	.96 sq. ft.
Average quantity of charge per cell.....	15 yards
Time required for combustion of charge.....	4 to 8 hours
Average amount consumed per hour per square foot of grate	17.3 lbs.
Average daily amount at time of report.....	650 yards
Equivalent in weight.....	260 tons
Cost of labor (23 men) per day.....	\$40.00
Average cost operating per ton.....	.15
Approximate cost of plant.....	\$75,000.00
Amount charged for incineration per yard.....	.25

THE WASTE COLLECTION OF SAN FRANCISCO

The collection of city's waste in San Francisco is made under the direction of a Scavenger's Association, which controls the entire service, making its own charge for collection from households and delivering the refuse at the works for disposal, paying 20 to 25 cents per cubic yard to the Reduction Company. The waste includes garbage, refuse and ashes mixed together, and is taken at the works just as it comes. No fuel is used for incineration except the material delivered.

These disposal works are the largest in this country, covering three sides of a square of 265 feet; the buildings are of brick with steel corrugate roofing, and the tipping platforms and approaches wide and convenient. The chimney was the largest of its class on the Pacific coast, 262 feet high, 32 feet square at the base, with a central circular shaft of 210 feet and 14 feet in internal diameter.

At the time of the earthquake the upper third of the chimney was broken off and in falling destroyed the flues connecting with the eastern battery of cells and so wrecked this set of cells as to put them out of use.

This plant, with the one in Montreal, are the only examples of the Thackeray incinerator in this country.

REPORT OF DECARIE INCINERATOR, SPOKANE, WASH.

JULY, 1904, TO JANUARY, 1905

Total tons of garbage and refuse.....	2,378.5
Total expense of operation, labor and fuel.....	\$1,877.40
Receipts paid for destroying manure.....	206.80
Average quantity per month, tons.....	396.4
Average per day, tons.....	13.2
Cost of disposal per ton operating expenses.....	\$0.722

REPORT FOR FOUR MONTHS, JANUARY TO MAY, 1905

Total garbage and refuse, tons.....	1,631.8
Average quantity per month, tons.....	408
Average amount daily, tons.....	13.5
Cost of disposal, operating expenses only, per ton.....	\$0.577

Analysis of waste:—

Garbage, 36.3 per cent.; rubbish, 44.3 per cent.; manure, 7.8 per cent.; market refuse, 9.3 per cent.; animals, 2.3 per cent.; total, 100 per cent. The city makes a charge for disposal of stable manure; no night soil is burned. The fuel is coal, coke, wood, edgings and saw dust. The number of men employed, foreman and three helpers.

THE WEEK'S CONTRACT NEWS

Relating to Municipal and Public Work—Street Improvements—Paving, Road Making, Cleaning and Sprinkling—Sewerage, Water Supply and Public Lighting—Fire Equipment and Supplies—Buildings, Bridges and Street Railways—Sanitation, Garbage and Waste Disposal—Police, Parks and Miscellaneous—Proposals and Awards

BIDS ASKED FOR

STATE	CITY	RECEIVED UNTIL	NATURE OF WORK	ADDRESS INQUIRIES TO
Street Improvements				
Pennsylvania	Brookville	November 8	Constructing 1,150-ft. road	Jos. W. Hunter, Harrisburg, Com'r
New York	Buffalo	November 9, 11 A.M.	Laying 12,200 yds. pavement on 5 streets	Francis G. Ward, Com'r Pub. Wrks
Pennsylvania	East Mead	November 9	Constructing 7,328 ft. road	Jos. W. Hunter, Harrisburg, Com'r
New York	Troy	November 9	8,700 yds. vitrified brick on concrete foundation, 3,800 ft. granite curbing	Jas. M. Riley, Bd. Contract and Sup.
Washington	Port Townsend	November 10, 11 A.M.	Constructing roads, gutters and catch-basins at Port Worden	Charles A. Clark, Quartermaster.
Pennsylvania	Woodcock	November 10	Constructing 4,002 ft. road	County Commissioners, Meadville.
Indiana	Perry	November 12, 11:30 A.M.	Improving highways	County Commissioners, Brazil.
Ohio	Cincinnati	November 12, noon	Grading 12,600 cu. yds.; granite blocks, 17,750 yds.; concrete blocks, 17,750 yds.; granite curb, 8,250 ft.; estimate, \$91,867.	Chas. N. Danenhowe, City Eng'r.
New York	Port Chester	November 12, 8 P.M.	9,700 yds. brick paving curbs and storm sewers	J. A. Kirby & Son, Engineers.
Ohio	Cincinnati	November 12, noon	Paving 17,400 sq. yds. bitulithic and 2,250 yds. with brick; estimate, \$35,527	Board of Public Service.
Virginia	Norfolk	November 12, noon	Grading and supplying stone for constructing 4½-mile boulevard to Exposition	H. B. Goodridge, Chairman Com.
Ohio	Ashtabula	November 13, noon	Grade drain, etc., Bell Street	Lewis A. Amsden, City Engr.
New Jersey	Hoboken	November 14, 8 P.M.	Repaving two streets with Belgian block	Jas. H. Londrigan, City Clerk.
Indiana	Celatur	November 16	Macadam road in Root township	C. D. Lewton, County Auditor.
Ohio	Cleveland Heights	November 20	Grade, macadamize, lay sidewalks, etc.	W. J. Phare, Village Clerk.
New Jersey	New Brunswick	November 21, 11 A.M.	Constructing two-mile stone road	L. C. N. Brogger, Jr., Perth Amboy.
New York	Brooklyn	November 21, 11 A.M.	Constructing asphalt plant	Bird S. Coler, President.
Ohio	Madisonville	December 24	Grade, curb and macadamize two streets	J. A. Conant, Village Clerk.
Alabama	Montgomery	November 26, noon	Pave four streets, brick, bitulithic or asphalt	R. S. Williams, City Treasurer.
Pennsylvania	Williamsport	December 1, noon	Constructing crossing under R. R. tracks	Jas. F. Fisher, City Engineer.
Indiana	Princeton	December 1	1,190 ft. cement walk, 11 ft. wide, and concrete coping 18 x 18 inches	Harry Embree, County Auditor.
Water Supply				
District of Columbia	Washington	November 10, noon	Furnishing curb and corporation cocks	H. B. F. Macfarland, Commissioner
Massachusetts	Boston	November 12, 2:30 P.M.	Installing two boilers with appurtenances	Hiram A. Miller, Chief Engineer.
Massachusetts	Holyoke	November 12, 7:30 P.M.	452 tons, 20, 16, and 12-in. C. I. water pipe, and 20,000 lbs. special castings	Charles River Basin, Commission.
Pennsylvania	Philadelphia	November 14, noon	Queen Lane, contingent of Torresdale filters; Contract No. 72	Jas. L. Tighe, City Engineer.
New Mexico	Fort Wingate	November 15	Construct reservoirs and connections	Jno. R. Hathaway, Dir. D. P. W.
Virginia	Fort Monroe	November 15	Constructing 50,000-gal. steel water tank	G. L. Morrison, Quartermaster.
Ohio	Cleveland Heights	November 20	Laying 6-in. cast-iron water pipe	Capt. R. H. C. Kelton, Q. M.
Massachusetts	Brockton	November 21, noon	Pumping engine, 6,000,000 gallons capacity	F. A. Pease, Eng. Co. Cleveland.
Ohio	Willoughby	November 26, noon	Extending water mains on four streets	Charles R. Felton, City Engineer.
Louisiana	Jonesville	January 2	Sinking an artesian well	L. R. yan, Clk. Bd. Pub. Affairs.
				T. M. Mathews, Mayor.
Sewerage				
Massachusetts	Brighton	November 9, 2:30 P.M.	Rock and earth tunnel, 6,350 ft. long; inside diameter 69 x 72 ins.; 300 cu. yds. Portland brick and 7,000 yds. concrete masonry; invert 28 to 60 ft. below street surface	Metropolitan Water and Sewerage Board, Boston.
New Jersey	Merchantville	November 10, 3 P.M.	Constructing sanitary sewer system, 9 miles, 8 to 15 in. vitrified pipe, 3,350 ft. iron pipe, disposal plant, etc.	City Wastes Disposal Company, New York, Engineers.
Ohio	Cincinnati	November 12, noon	Sewers, 12 to 21 ins.; cost, \$9,155	Chas. N. Danenhowe, City Eng'r.
Iowa	Waterloo	November 12	4,360 ft. drainage ditch, Cedar township	J. J. Rainbow, Clk. Bd. Pub. Serv.
Ohio	Steubenville	November 12	Constructing sewer in Sixth Street	T. W. Vance, Clerk, Bd. Pub. Serv.
Ohio	Cleveland	November 13, noon	Constructing two main intercepting sewers	A. R. Callow, Sec'y Bd. Pub. Serv.
Iowa	Des Moines	November 15, 11 A.M.	Constructing Grand View System; 27,897 ft. 8 to 30 in. sewer	W. W. Wise, Bd. Pub. Works.
Iowa	Rockwell City	November 15	Drainage system in two townships	Calhoun County Commissioners.
Nebraska	Fairbury	November 17	Constructing 64,000 ft. 8-in. sewer	W. W. Watson, City Engineer.
Pennsylvania	Washington	November 19, noon	Municipal Sewage Purification Works	O. K. Taylor, Borough Engineer.
Ohio	Perrysburg	November 19	15-in. storm sewer, catch basins, etc.	Wm. Charles, Clerk Bd. Pub. Serv.
California	Los Angeles	November 19	Section 3, outfall sewer; \$100,000 bond	Board of Public Works.
Ohio	Cleveland Heights	November 20, noon	Sanitary sewers in Plaisted Court	F. A. Pease, Eng. Co., Cleveland.
Ohio	Norwood	November 26, noon	Excavating, sewer-pipe, brick and man-hole covers, for sanitary sewers, District No. 3	Jas. A. Stewart, Cincinnati, Eng'r.
District of Columbia	Washington	November 27, noon	Constructing sewers	H. B. F. Macfarland, Commissioner
Illinois	Rock Island	December 1, 5 P.M.	Sewers, drains, catch-basins, etc., District No. 2, Southwest Sewer System	Wallace Treichler, City Eng'r.
Georgia	Eatonton	December 1	Constructing sewer system; cost, \$15,000	E. H. Davis, Engineer.
Ohio	St. Mary's	January 30	Complete sanitary sewer system, 14 miles	Riggs & Shermann, Toledo, Eng'rs.
Public Buildings				
New York	New York	November 8, 10 A.M.	Repairs, painting, etc., six police stations	Theodore A. Bingham, Com'r.
New Jersey	Dover	November 8	Constructing two brick and steel store houses, U. S. Powder Depot	Commanding Officer.
District of Columbia	Washington	November 12, 2 P.M.	Erecting fire-proof mess hall and dormitory building	Capt. J. S. Sewell, Soldiers' Home.
Iowa	Council Bluffs	November 12	Erecting school in Lewis township	H. A. Ellerbeck or Albert Anderson.
Wisconsin	Hayward	November 12	Steam heating plant in Court House	R. J. Hennessey, Chm. Com.
Wisconsin	Superior	November 12	Low pressure steam heating apparatus for U. S. Post Office Building	J. K. Taylor, Washington, D. C.

Public Buildings—Continued

New York	New York	November 14, 10:30 A.M.	Erecting engine house and hose rack	Francis J. Lantry, Commissioner.
Iowa	Des Moines	November 14, 2 P.M.	Garbage crematory bldg. complete. veterinary stable and alterations, etc., other bldgs.	W. E. Cole, Quartermaster.
Michigan	Ann Arbor	November 14, 7:30 P.M.	Constructing City Hall; cost, \$26,000	E. W. Groves, City Engineer.
New Jersey	Hoboken	November 14, 8 P.M.	Constructing engine house, Fifth Ward	Jas. H. Londrigan, City Clerk.
Maryland	Baltimore	November 14	Heating and plumbing, State Insane Hosp.	Owens & Cisco, Architects.
District of Columbia	Washington	November 15, 2 P.M.	Brick outbuilding, Battle Ground Cem'y	Capt. H. L. Pettus, Quartermaster.
New Jersey	Paterson	November 16	High school, to cost \$400,000	Wm. T. Fanning, Architect.
Kansas	Kansas City	November 19	Steam heating plant	Frank M. Holcomb, County Clerk
New Jersey	Oakland	November 20	Erecting school No. 1	D. C. Bush, Jr., Bd. Education.
California	San Francisco	November 21, 11 A.M.	Repairs to General Hospital, Presidio	Jno. L. Clem, Chief Quartermaster.
District of Columbia	Washington	November 21	Interior marble work, Senate office bldg.	Elliott Woods, Supt. Capitol.
Ohio	Columbus	November 21	Erecting \$30,000 cottage and \$10,000 barn	F. L. Packard, Architect.
Virginia	Norfolk	November 27, 10 A.M.	Power house, oil house, etc., at navy yard	H. T. B. Harris, P. M. G., U. S. Navy
Vermont	Fort Ethan Allen	November 29, 2 P.M.	Remodeling bldgs., electric lighting, etc.	Washington, D. C.
Mexico	Vera Cruz	December 1	Remodeling City Hall, cost, \$150,000; erecting general prison; cost, \$125,000	Lt. M. G. Holliday, Quartermaster.
Connecticut	Hartford	December 9, noon	Constructing State armory and arsenal	City Engineer.
Louisiana	Shreveport	December 20	Erecting \$75,000 City Hall	Benj. W. Morris, New York, Arch.
Ohio	Marion	April 1	Four-story addition to school; cost, \$10,000	C. G. Rives, City Comptroller.
				Geo. B. Christian, Jr. Clerk., Bd. Ed

Bridges

Kansas	Wichita	November 10, noon	Two 60-ft. and a 30-ft. steel or arch cement bridges, 380-ft. pile bridge and I-beam, 40-ft. steel approach to bridge	C. N. Cartwright, County Clerk.]]
Missouri	Independence	November 14, 10 A.M.	30-ft. I-beam steel bridge, stone abutments, 40 and 36-ft. steel bridges, 5 stone arch culverts	Oscar Koehler, Bridge Com'r.
Iowa	Tipton	November 14, noon	Building and repairing bridges for 1907	W. A. Hamm, County Auditor.
Iowa	Denison	November 14	Building and repairing wood and iron bridges	Edw. Theobald, County Auditor.
Ohio	Columbus	November 14	Constructing new floor system on bridge	W. C. Cussins, County Auditor.
Missouri	Independence	November 10, 11 A.M.	Constructing small culverts and bridges	Oscar Koehler, Bridge Com'r.
Kansas	Kansas City	November 10	Constructing steel stringer bridge	Frank M. Holcomb, County Clerk.
Manitoba	Winnipeg	November 20, 2:30 P.M.	Superstructure steel highway bridge	H. N. Rutan, City Engineer.
New Jersey	Perth Amboy	November 21, 11 A.M.	Removing 450-ft. pile trestle, and erecting three 150-ft. steel spans	L. C. N. Brogger, Jr., County Eng'r
California	Gilroy	November 20	Concrete bridge, two 30 and one 40-ft. spans; estimated cost, \$15,000	J. G. McMillan Co., San Jose.]]

Miscellaneous

New York	New York	November 8, noon	Removing snow and ice, Boroughs of Brooklyn and Bronx, winter 1906-07	M. Craven, Com'r Street Cleaning.
New York	Albany	November 8	Enlarging Erie and Champlain canals, excavating, bridge work, etc.; three contracts; total cost, \$3,038,621	N. V. Franchot, Supt. Pub. Works.
Pennsylvania	Philadelphia	November 9, noon	Cleaning streets, removing household waste, removal of snow and ice by load	Jno. R. Hathaway, Dir. D. P. W.
Virginia	Lynchburg	November 10, 3 P.M.	Apparatus, machinery, etc., for complete arc lighting plant, steam and water power	Lamar Lyndon, New York, Eng'r.
Alabama	Mobile	November 12	Constructing municipal electric light plant	P. J. Lyons, Mayor.
District of Columbia	Washington	November 13, 10 A.M.	Planer, 2 motor-driven pumps, 60-ton crane	H. T. B. Harris, P. M. G., U. S. Navy.
California	San Francisco	November 13	Three electric traveling cranes for Mare Island Navy Yard, Sch. 201	H. T. B. Harris, P. M. Gen., U. S. Navy, Washington, D. C.
Iowa	Fort Des Moines	November 14, 2 P.M.	Garbage crematory and building	W. E. Cole, Quartermaster.
Ohio	Newburg Heights	November 14	Constructing and operating street railways under Ordinances 77 and 78	P. S. Ruggles, Village Clerk.
Kansas	Chanute	November 15	Preparing 50 miles roadbed and subgrade for Southwestern Traction Company	Cudworth, Axtell & Co., Kansas City, Mo.
New York	Niagara Falls	November 16, noon	Building new station and reconstructing inclined railway, State Reservation	G. L. Heins, Albany, State Arch.
Georgia	Fort Screven	November 17	Constructing concrete sea wall	Capt. Jos. T. Davidson, Q. M.
District of Columbia	Washington	November 20, 10 A.M.	Furnishing vitrified paving block, brick, arc lamps, carbon, etc., electrical supplies, pipe, steel, cement, etc., at various navy yards	H. T. B. Harris, P. M. G., U. S. Navy.
Wisconsin	Keshena	November 23, 2 P.M.	Electric-light plant at Green Bay School	Shepard Freeman, Superintendent.
Louisiana	New Orleans	November 24	Strengthening old and building new piers at Naval Station	Mordecai T. Endicott, Navy Dept., Washington, D. C.
New York	Peekskill	December 1	Building Putnam and Westchester Traction Co. line to Oregon, 3 1/2 miles	John S. Ladd, President.
South Carolina	Rock Hill	December 1	Installing electric-light system and steam plant to light city, population, 8,000	C. S. May, City Clerk.
Ohio	Cleveland	December 3	Constructing, maintaining and operating street railway in city	Peter Witt, City Clerk.
Mississippi	Greenville	December 31	Building 61-mile line for Greenville, Leland and Rolling Forks Co. Railway	W. R. Barksdale, Memphis, Tenn., President.

LOWEST BIDS FOR CURBS AND SIDEWALKS

CURBING						SIDEWALKS						REMARKS
SETTING NEW			RESETTING OLD			SURFACE MATERIAL			FOUNDATION		Contract Price per Sq. Yd.	
Lineal Feet	Character of Work	Contract Price	Lineal Feet	Character of Work	Contract Price	Area, Sq. Yds.	Kind	Thick-ness	Kind	Thick-ness		
CANTON, O.												
3,490	6"x20" sand-stone, str't.	0.37	1,516	.....	0.15	444	Flagstone.....				\$1.26	
244	Ditto, circle..	0.40	860	.....	0.14		Flagstone.....				1.31	
2,843	Ditto, str'ght.	0.44	3,020	.....	0.45	1,665	.....				
ST. PAUL, MINN.												
2,170	5"x18" sand-stone.....	0.85	4,235	5"x18" sand-stone.....	0.55	.....	Concrete... 4"	Cinders..... 8"			\$1.35-\$1.53	Tile longitudinally under walk.
CHICKASHA, I. T.												
5,000	Concrete curb & gutter	0.00.....										
FT. DADE, FLA.												
						2,333	1:2 cement.	1"	1:2:4 concrete	4"	1.80 1.98 2.25	All local sand. River sand in surface Silica " " "

The Municipal Journal and Engineer wishes to obtain, at the earliest possible moment, advance and reliable information respecting all work projected. Any items sent us will be greatly appreciated. On request, copies containing such information will be mailed to you.

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The Editor, Contract News Section,
The Municipal Journal and Engineer,
Flatiron Building, New York City

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publishes more Municipal Contract
News than any other paper

All items arranged alphabetically
by States.

STREET IMPROVEMENTS

Birmingham, Ala.—The proposition of issuing bonds to pave certain portions of Avenue A will be submitted to a vote of the people.

Moline, Ill.—Council has decided to pave Third street with brick.

Indianapolis, Ind.—The Western Construction Company was low bidder on paving Park avenue with asphalt, at \$3.60 a lineal foot; other bidders were the Marion County Construction Company, the Barber Asphalt Paving Company, and the Union Asphalt Paving Company.

Des Moines, Ia.—Council has decided to pave certain portions of Fifth avenue.

Wichita, Kan.—The cost of paving Topeka avenue is estimated at \$5,095.24, and Lawrence avenue \$7,552.37; the City Engineer has been authorized to purchase five tons of asphalt cement for repairing pavements.—Finlay Ross, Mayor; R. N. Door, City Clerk.

Louisville, Ky.—The Board of Public Works has awarded the contract for paving with brick several alleys to Humpich & Staebler, at \$1.45 per square yard; total, \$18,500.

New Orleans, La.—Arrangements are being made to pave St. Roch avenue and also several roads.

Taunton, Mass.—Hadsam & Co., of Worcester, have been awarded contract for 5,500 square yards, cement paving, on Summer street, at \$1.60 per square yard.

Port Huron, Mich.—A. J. Murphy has contract to repave 9,500 yards, formerly paved with cedar block, with brick, at \$1.46 per square yard, Metropolitan block, cement filler, 6-inch concrete base, and ten-year guarantee; this is the lowest bid ever received by the city for this class of pavement; the Jenks-Wade Company is laying cement walks for 8½ cents per square foot.—W. W. Phelps, City Engineer.

Brookhaven, Miss.—Bids will be received by the Natchez & Eastern Railway Company, at the office in Brookhaven, Miss., for the grading of about twenty-one miles of roadbed in Franklin County, Miss.

Effingham Falls, N. H.—The contract for grading and surfacing with gravel a portion of Main street has been awarded to Frank W. Brooks, of Freedom.—A. W. Dean, State Engineer.

Camden, N. J.—Council has passed ordinance directing the repaving of Broadway and the paving of State and Kimber streets with sheet asphalt on a concrete foundation.—Charles S. Wolvestor, President of City Council.

Newark, N. J.—The Standard Bitulithic Company, New York City, has contract for paving with bitulithic a portion of Central avenue, at \$2.10 per square yard.

Fort Ontario, N. Y.—Mosier & Summers have contract for grading at the post; 45 cents per cubic yard for earth excavation and \$3 per cubic yard for rock excavation; cost not to exceed \$22,500, the sum appropriated.—Henry H. Hall, Constructing Quartermaster.

Raleigh, N. C.—An election will be held in November to vote on issue of \$300,000 road bonds.

Akron, O.—City Engineer Paine estimates the cost of paving the roadway and laying cement walks along Marvin avenue at \$4.25 per foot, this, together with the cost of sewerage the street, will amount to \$14,000. E. McShafery & Son have the contract for paving Long street at \$7,000, work to be started in the spring; Superintendent of Streets Edward Dunn has recommended the paving of Quarry, Church, and State streets with cobble stone; the Diamond Rubber Company has asked to have Pleasant street paved. The

City Engineer is drawing plans and the improvement will be authorized by Council.

Canton, O.—Legislation has been commenced and estimates asked for ten miles of street paving and grading for next year; the improvements contemplate the paving of Navarre, East Eighth, North McKinley, Lincoln, West Fifth, and Charles streets.—William F. Sarver, City Engineer.

Cincinnati, O.—The Board of Public Service has rejected all bids for the improvement of Clifton avenue with granite paving at an estimated cost of \$77,000; Henkle & Sullivan were the lowest bidders.

Cleveland, O.—Resolutions have passed Council calling for the paving with brick of Hoppensack and Dollenbaugh avenues, West Seventy-eighth, Orton court, and East Thirtieth streets, Frazee avenue, East Eleventh, East One Hundred and Twelfth, and East Sixty-sixth streets, and Chambers avenue.—Peter Witt, City Clerk.

East Liverpool, O.—General Manager J. C. Rothery states that the East Liverpool Traction and Light Company will pave eighteen feet of Pennsylvania avenue its entire length as soon as the city is ready to pave its share of the thoroughfare; this is one of the longest streets in town.

Findlay, O.—The paving of River road is estimated to cost \$4,700.—City Engineer Rejgle.

Hamilton, O.—The Andrews Paving Company has been awarded the contract for paving Park avenue with sheet asphalt, at \$23,000; the total number of feet is 4,300.

Martins Ferry, O.—Contracts for paving West Washington street with brick have been granted the Metropolitan Brick Company, of Canton; the county road to Frank Archer, and Jefferson street to the Suburban Brick Company; the Tenth street contract was not awarded and the bids for the sewer districts were all rejected.

Toledo, O.—The contract for paving Scottwood avenue with bitulithic has been awarded to H. P. Stricher, at \$5,604.

Enid, Okla.—The Warner-Quinlin Company, of Syracuse, N. Y., has been awarded the contract for paving certain streets in this city with asphalt.

Wilkesbarre, Pa.—Post & Co. have secured the contract for paving the State road between Ashley and Sugar Notch, for \$9,000.

Clinton, Tenn.—R. L. Peters, of Knoxville, has secured the control for about thirteen miles of macadam road for about \$40,000.—J. K. P. Wallace, Chairman, County Commissioners.

SEWERAGE

Waterbury, Conn.—Blake Bros. & Co., Boston, Mass., are the purchasers of \$100,000 worth of 4 per cent semi-annual sewage disposal bonds, for \$103,650; other bidders were Denison & Farnsworth, Boston; N. W. Harris & Co.; Rhoades & Co., New York; Blodgett, Merritt & Co., New York; R. L. Day Company, Boston; Kountz & Co., New York; Moore, Baker & Co., Boston; Jackson & Curtis, New York; E. H. Gay Company, Boston; Connecticut Savings Bank, New Haven; W. J. Hayes & Co., Boston.

Portland, Ind.—Council has awarded contract for furnishing plans and specifications for a complete sewerage system for Portland to the Riggs & Sherman Company, of Toledo, O.

Richmond, Ky.—An election will be held in November to vote on the question of issuing \$30,000 sewer bonds.

Gloversville, N. Y.—Bids will be called for early next year for the proposed sewage disposal plant; cost, \$150,000.—Morrill Vrooman, City Engineer.

Fayetteville, N. C.—Abel & Edwards, of Hickory, have the contract for constructing a portion of the sewerage system for \$19,500.

Canton, O.—Plans and estimates are being prepared for four miles of sanitary and storm sewers, which will be constructed next year.—William F. Sarver, City Engineer.

Cuyahoga Falls, O.—Arrangements are being made to construct a sewer system to cost \$75,000; the proposition to issue bonds for the purpose will be submitted to a vote.

Milan, O.—Chief Engineer Pratt, State Board of Health, estimates that the town can be sewerage at a cost of about \$10,000; he has outlined a general plan which will enable the work to be done early in the year; a bond sale will be advertised.

Oberlin, O.—City Engineer Barry estimates the cost of constructing a sewer system and a disposal plant at about \$125,000; his estimate includes fourteen miles of iron sewer pipe line, of which seven miles would be 38-inch pipe, two miles 12-inch, two miles 6-inch, three miles 10-inch, and about 2,000 feet of 15-inch pipe.

Springfield, O.—The State Board of Health has decided that this city will not have to build a sewer disposal plant before beginning work on the construction of the sewer system. This will also save the construction of a pumping station and a low-level inspector, saving \$200,000.

Toledo, O.—The Board of Public Service will condemn the right-of-way for the 54-inch sewer in Auburndale. The State Board of Health has ordered the city to build a purification plant as soon as the sewage becomes a source of contemplation.

Warren, O.—The Sewer Committee of the Council will report in favor of improving Niles and Youngstown avenues by the construction of a 12-inch lateral sewer.

Shawnee, Okla.—Bonds of \$175,000 have been issued for constructing a complete sewer system.

East Brady, Pa.—The State Board of Health has granted the borough permission to extend its sewerage system.

Easton, Pa.—Williams, Proctor & Potts, of New York City, will furnish complete working plans for the construction of a sewerage system and the disposal of sewage; also a storm drainage system, both surface and underground; also a general detailed plan and approximate cost of a municipal water plant, with the privilege of securing a plan and estimate for an electric-light plant.

Elm Grove, W. Va.—Contract will be let in the near future for constructing a sewerage system.—J. E. Raub, Engineer-in-Charge.

Oshkosh, Wis.—A sewer system is to be constructed from this place to Fond du Lac in the near future.

Racine, Wis.—The Board of Public Works has been instructed to prepare plans, specifications, and estimates for sewers in Water, Villa, and Fifteenth streets.—O. C. Peterson, Chairman, Council Street Committee.

WATER SUPPLY

Ada, Ark.—A proposition to issue bonds to the amount of \$40,000 for waterworks carried.

Los Angeles, Cal.—Bids for furnishing nearly \$150,000 worth of castiron water-pipe have been opened by the Board of Public Works; the contract, when let, will be the largest of the year, as more than thirty-five miles of pipe will be furnished.

Peoria, Ill.—South Washington street is soon to be provided with water-mains; pipe is on the ground and excavating will commence at once.

Columbus, Ind.—The Board of Public Works will receive bids for the improvement of the waterworks system.

Culver, Ind.—Council has authorized an issue of \$4,000 5 per cent. waterworks bonds.

Coalgate, I. T.—The citizens have voted to issue \$70,000 waterworks and school bonds.

Centralia, Mo.—Franchise has been granted to the city to install a waterworks and fire-fighting system.

Kansas City, Mo.—The Board of Public Works plans to build an intake from the river at the Quindato pumping station.—Steven Mitchell, Chief Engineer.

Trenton, Mo.—The Board of Public Works has decided to lay 3,300 feet of 6-inch water main; more extensive improvements will be made later.—W. S. Rynearson, City Clerk.

Rolla, Mo.—The citizens have voted to issue \$60,000 bonds for waterworks and sewer construction.

Billings, Mont.—The question of issuing \$400,000 water system bonds carried.

Lincoln, Neb.—December 11 the citizens will vote on the question of issuing \$12,000 waterworks and light bonds.

Camden, N. J.—Council has appropriated \$10,000 for repairing wells at Morris Station, equipping certain wells with an air-lift system, and for making other improvements, and for maintenance.—Charles S. Wolvestor, President of City Council.

Brooklyn, N. Y.—Plans are being prepared for constructing 14¼ miles of water mains, to be laid in forty streets, including 2,170 tons of pipe and 190 hydrants; cost, \$130,000.—John H. O'Brien, Commissioner of Water Supply, Gas, and Electricity.

Queens, N. Y.—At the meeting of the Improvement Association it was decided to issue bonds for the construction of water mains.

Akron, O.—The citizens will vote December 17 on the proposition to issue bonds in the sum of \$200,000 to establish a municipal waterworks plant.

East Liverpool, O.—The Board of Public Service will recommend the expenditure of \$20,000 for waterworks extensions and for filtration; new pumps are needed and a small filtration plant will likely be built.

Hamilton, O.—The following ordinances have passed the Council: Fifty-five thousand dollars city bonds, and \$115,000 bonds for improving and enlarging waterworks plant.

Jefferson, O.—The construction of a complete system of waterworks is being considered by the City Council.

Clinton, Okla.—The proposition to issue \$32,000 bonds for waterworks is under contemplation.

Reading, Pa.—A filter plant, to cost \$150,000, is to be built at the Bernhardt reser-

voir; the construction of an additional pipe line is also being considered.

Hartsville, S. C.—By a unanimous vote the citizens decided on the establishment of a waterworks system.—J. J. Lawton, A. M. McNair, H. L. Law, Water Commissioners.

Norway, S. C.—The issue of bonds for constructing a waterworks plant is under consideration.

Memphis, Tenn.—Bonds have been issued for \$200,000 for improving the waterworks.—Wirt F. Wells, President, Board of Commissioners.

Edinburg, Va.—T. A. Malone has the contract at \$6,573.25 to construct water mains.

Manassas, Va.—Thomas & Co., Harrisonburg, Va., was the only firm submitting a bid for constructing waterworks, at \$37,879, and the same was rejected; new bids are invited.—O. E. Newman, Chairman, Construction Committee.

Norfolk, Va.—J. W. Davis, of Newport News, has contract to build the Exposition reservoir, of reinforced concrete, with a capacity of 2,000,000 gallons.

LIGHTING AND ELECTRICITY

Gadsden, Ala.—Citizens' Light and Fuel Company, capitalized at \$75,000, has been incorporated; a gas plant will be built on a site which has been purchased, and a franchise secured from Council.—J. H. Hammond, President.

Manitou, Col.—The Hydro-Electric Company will build a new power plant at this place.

Vidalia, Ga.—The citizens will vote on the issuance of \$25,000 bonds for constructing an electric-light plant and waterworks.

Wrightsville, Ga.—An election was held for the purpose of determining whether the city of Wrightsville should issue bonds to install an electric-light plant and waterworks. It was decided to issue \$35,000 in bonds.

Channahon, Ill.—D. W. Mead, Consulting Engineer, First National Bank Building, Chicago, has prepared plans for a heat, light, and power plant to be built at Channahon, for the Channahon Power Company.

Galesburg, Ill.—Council has granted the People's Electric Power Company a franchise to construct and maintain an electric-light plant.

Springfield, Ill.—The Springfield Gas-Light Company is considering the construction of a gas-plant to cost about \$250,000.

Carthage, Ind.—The Carthage Light, Heat, and Power Company will receive bids for the construction of an electric-light, heat, and power plant.—Address John W. Beck, or J. O. Overman.

Sapulpa, I. T.—A new electric-light company has been formed to establish an electric-light plant, to cost \$20,000.—E. C. Reynolds, Tulsa, President; J. A. Boyd, Secretary.

Atlantic, Ia.—The citizens will vote on the question of granting Messrs. Ross & Judd a 25-year franchise for the use of the streets for light, heat, and power; also a 25-year franchise for the use of the streets for operating an electric line; it is proposed by Council to build an electric line from Atlantic to Elk Horn.

Wellington, Kan.—The citizens have voted to issue \$10,000 electric-light bonds, \$15,000 city building bonds, and \$30,000 waterworks bonds.

Morgan City, La.—The Morgan City Electric Light Company has been incorporated with a capital stock of \$24,000 for the purpose of conducting an electrical supply business.—B. M. Young, President; H. M. Young, Secretary.

Napoleonville, La.—The city will erect an electric-light plant.

Hancock, Mich.—The Cooper Range Consolidated Mining Company will erect an electrical power plant at Portage Lake, to cost \$500,000.

South Boardman, Mich.—W. C. Blackman has purchased the burned South Boardman electric-light plant and will rebuild at once.

South Haven, Mich.—The Board of Public Works will expend \$17,000 extending and repairing the electric-light plant, \$7,000 extending and repairing the water plant, and \$20,000 in constructing a new intake.

Cleveland, O.—The Erie Railroad Company will commence the construction of a large, new electric-power plant at the company's ore docks to operate the extensive ore-unloading machinery; estimated cost, \$500,000; the plant will consist of new boilers, engines, and dynamos for the generating of electricity.

Marion, O.—Alfred Shaw, representing the United States Light and Power Company, of Cleveland, a company recently incorporated with a capital stock of \$250,000, has petitioned

Council for a franchise to erect an electric-light, power, and heating plant.

Toledo, O.—Homer T. Yaryan will build a new heating and lighting plant.

Timmonsville, S. C.—The town will let a franchise for constructing an electric-light plant.

Palestine, Tex.—Captain George W. Burkitt, William Broyles, and others will build an electric-light plant; the most modern machinery will be installed.

Wichita Falls, Tex.—The Citizens' Electric Light and Power Company has been incorporated by T. J. Taylor, E. P. Walsh, J. D. Avis, and others; an electric and power plant will be established.

Salt Lake City, Utah.—The Utah County Light and Power Company has been granted a 50-year franchise to construct and maintain an electric-light and power system over the highways of the county from the company's plant in American Fork Canyon to Bingham Junction by way of Draper and Sandy.

Norfolk, Va.—L. Feuerstein and others will erect a \$100,000 ice and cold-storage plant; the machinery will be operated by electricity, for which a complete electric plant will be installed.

FIRE EQUIPMENT AND SUPPLIES

Redland, Cal.—Council has been petitioned to issue bonds for the purpose of establishing two additional fire stations with complete apparatus.

Pekin, Ill.—The Glucose Works are having plans prepared for the erection of a private firehouse, the works being too far from the city's firehouse.

Streator, Ill.—The Water and Light Committee has recommended to Council the purchase of 800 feet of hose.—Fire Chief Owen.

Burlington, Ia.—Arrangements are being made to construct two new fire stations.

Neodesha, Kan.—The purchase of a gasoline automobile and a combination hose and ladder wagon is being considered.—J. H. Fleming, Fire Chief; B. H. Hill, Secretary.

Hubbell, Mich.—Arrangements are being made to install a complete fire alarm system.

St. Joseph, Mo.—Arrangements are being made to erect an additional fire station; a lot has been purchased for the purpose.

Pinoka, Alta, Can.—The town will expend \$7,200 for fire protection and a fire hall.

Stockton, Ont., Can.—The Police and Fire Commissioners, W. E. Johnson and Al Musto, recommend the erection of an additional engine house.

PUBLIC BUILDINGS

Agnews, Cal.—The rebuilding of the State Hospital with concrete on a steel frame is favored by the State Lunacy Commission.—Howard & Galloway, architects.

Antler, I. T.—Bonds, \$8,000, have been voted for school purposes.

Ann Arbor, Mich.—Plans have been prepared for a City Hall building, 57x100 feet.—H. M. Pipp, architect.

River Rouge, Mich.—A modern ten-room schoolhouse is to be erected.—H. Vigar, Chairman, Building Committee, Board of Education.

Amory, Miss.—An issue of \$14,000 school building bonds has been authorized by Council.

Towner, N. D.—At the coming election the people of McHenry County will vote on issue of \$50,000 Court House bonds.

Mansfield, O.—Council is considering the erection of a \$75,000 city building and market house.

Pittsburg, Pa.—Two new city police stations are to be erected at a cost of \$20,000 each.—Frank Ridgeway, Director of Public Safety.

Greenville, S. C.—Plans have been prepared for a \$15,000 city hospital.—G. E. Sirrine, architect.

Memphis, Tenn.—All bids for plumbing in the City Hospital have been rejected; the plans will be changed and new bids invited.

Channing, Tex.—The School District proposes to issue \$8,000 school bonds.

Laredo, Tex.—The Webb County Court House, destroyed by fire recently, is to be rebuilt.

Norfolk, Va.—The erection of a \$200,000 high school building is being considered.—Dr. L. T. Royster, Building Committee.

Richmond, Va.—Plans have been adopted for the colored almshouse.—Mayor McCarthy.

Seattle, Wash.—The citizens will vote on issue of \$125,000 bonds for the purpose of completing the new Municipal Building.

Notre Dame de Grace, Que., Can.—A Town Hall and fire station are to be erected; the site has been selected.

STREET RAILWAYS

San Bernardino, Cal.—The San Bernardino Valley Traction Company has been granted a franchise to build its Arrowhead electric railway across the Hall ranch and the property of G. A. Emerick.

San Francisco, Cal.—The United Railroad has placed an order with a New York City firm for 500 new searchlights of the latest pattern, which will throw a path of light 2,000 feet.

Miami, Fla.—The Miami Electric Street Railway Company is making preparations to build two extensions.

La Porte, Ind.—Council has granted a 50-year franchise to the Cooperative Construction Company, which proposes to build an electric line from Chicago to New York.

South Bend, Ind.—The Winona & Maximukkee Electric Railway Company has been incorporated for the purpose of constructing an electric line from Culver to Warsaw.—Edwin P. Taylor, S. S. Perley, T. P. Moredock, and others, incorporators.

Chickasha, I. T.—Scott Jones contemplates the construction of an electric interurban line between Chickasha and Andarko, Okla., by way of Verden.

Allegan, Mich.—The Trans-Michigan Street Railway Company has been incorporated for the purpose of building an electric road from Allegan to South Haven.—John Hensel, F. B. Kamarke, John Klein, and Thomas Samp, promoters.

Boyer City, Mich.—White Brothers, who own a railroad from Boyer City to Gaylord, are preparing to extend the road to Alpena.

Roseau, Minn.—A meeting of the business men of Roseau, Badger, Greenbush, and other nearby towns has been called to discuss ways and means to raise money to finance an electric railway, which it is proposed, to build from Roseau to Karlstad, a station on the Winnipeg line.

Lisbon, O.—Council has granted the Youngstown & Ohio River Railroad Company a franchise to construct its line across East Walnut and East Chestnut streets and Pritchard avenue.

Massillon, O.—The Massillon & Western Railway Company has been incorporated with a capital stock of \$10,000 by William A. Schuster, H. W. Loeffler, C. F. Dow, Louis A. Koons, and George W. Kratsch.

Springfield, O.—Council has passed an ordinance granting the American Railway Company, of Philadelphia, Pa., a 25-year franchise for a two-mile extension of its railway system through the factory district.

Cheyenne, Okla.—The Oklahoma, Texas & Western Railway Company has been incorporated to operate a line of railway from Clinton in Custer County to Cheyenne in Roger Mills County; capital stock, \$2,000,000.

—L. L. Collins, Milo Burlingame, A. O. Miller, and others, directors.

MUNICIPAL CIVIL SERVICE COMMISSION

299 Broadway.

New York, November 5, 1906.

Public Notice is hereby given that applications will be received until 4 P.M. Monday, December 3, 1906, for the position of Topographical Draughtsman.

The examination will be held on Wednesday, December 12, at 10 A.M.

For scope of examination and further information, apply to the Secretary.

FRANK A. SPENCER, Secretary.

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For Machines to Drill, Blast and Test Holes and Water Wells, write "LOOMIS CO., TIFFIN, O."

Reeves, E. T. Hathaway, O. D. Halsell, and others, directors.

Carnegie, Pa.—The Pittsburg Railways Company will build an interurban road from Carnegie to Wheeling Junction, W. Va., and from Wheeling Junction the road will later be extended to Follanshee.

Greensburg, Pa.—The Pittsburg & Westmoreland Traction Company has been incorporated with a capital stock of \$72,000 for the purpose of building a line to Latrobe. Wesley F. Raymond, Middletown, President; John R. Geyer, E. K. Condran, Charles Hatton, and others, directors.

Beaumont, Tex.—The County Commissioners' Court has granted a franchise to construct an interurban electric railway to Port Arthur, via Spindletop, Nederland, and Port Neches.

Dallas, Tex.—The Texas Traction Company has been incorporated with a capital stock of \$3,000,000 for the purpose of constructing an electric line to Sherman, and to own and operate street railways in both cities. F. H. Proctor, Boston, Mass.; J. F. Strickland, and J. N. Simpson, of Dallas, Tex., and others, incorporators.

Ogden, Utah.—The Ogden Rapid Transit Company has decided to appropriate \$40,000 for the purpose of electrifying its line to the Utah Hot Springs; the company will also consider the extending of its lines to Brigham City.

BRIDGES

Albany, Ga.—The Albany & Northern Railway and the City of Albany have reached an agreement, as the result of which the road will be permitted to build through Front street; the plan calls for the construction of a tunnel nearly 400 feet in length.

Hutchinson, Kan.—A resolution has passed Council declaring it necessary to build a viaduct across the Santa Fe tracks at Adams street.

Duluth, Minn.—The Great Northern Road is planning to raise the Interstate bridge which connects Duluth and Superior, four or five feet in connection with the work of restoring the wrecked draw span.

St. Joseph, Mo.—The Benton Harbor and St. Joseph Bridge Committee has decided to build a substantial bridge over the St. Joseph River; estimated cost, \$90,000.

Cincinnati, O.—Council has passed an ordinance authorizing issue of \$36,000 bonds for a bridge over the tracks of the C., H. & D. Railroad.

Toledo, O.—Preliminary plans for a steel bridge for the Board of Commissioners of Lucas County have been prepared by the Osborne Engineering Company, Osborn Building, Cleveland; the structure will be 80x120 feet.

Sewickley, Pa.—Surveys have been made and plans are being considered for the erection of a bridge over the Ohio River to have a 900-foot span; estimated cost, \$45,000.—Address W. Y. Sibert, Government Building.

Texarkana, Tex.—The construction of a bridge one mile long to span the Sulphur River twenty-one miles from Texarkana, is being planned.

Spokane, Wash.—The Wallace-Coates Company, of Portland, Ore., has the contract to draw plans and specifications for permanent bridges across the Spokane River at Washington street on the north channel of Howard street, and for the Y bridge, where Howard street intersects Havermale Island.

Milwaukee, Wis.—The Board of Supervisors has called for plans and specifications for the construction of the Grand avenue viaduct; estimated cost, \$150,000.

Brantford, Ont., Can.—The Grand Trunk Railway System has decided to build overhead bridge just outside the city.—Joseph Hobson, Montreal, Que., Chief Engineer.

MISCELLANEOUS

Oakland, Cal.—Council has appropriated \$10,000 for the improvement of West Oakland Park.

New Haven, Conn.—The issue of \$300,000 bonds is proposed, the money to be used for extension of Crown street, extension of Lombard street, widening of Grand avenue, construction of new Hall of Records, and establishment of artificial lake at base of East Rock and perhaps establish means of garbage crematory.

Moline, Ill.—Bids will shortly be invited for the construction of a 40-ton garbage crematory, to cost \$20,000 or \$30,000.

Fort Ontario, N. Y.—Lewis & Kitchen, Chicago, Ill., have contract for garbage crematory, at post for \$3,586.—H. H. Hall, Constructing Quartermaster.

Springfield, O.—The citizens will vote on issue of \$125,000 bonds for various public improvements.

Huntington, W. Va.—Bids are being received for constructing a garbage incinerator.

INCORPORATIONS

Caccavajo & Pruyn, New York City; engineers, construction. Capital, \$100,000. Incorporators: Thomas F. Adams, Long Island City, L. I.; George F. Raftery, 87 East Tenth street; John Z. Lowe, Jr., 367 West 20th street; M. E. Noethling, 69 West 108th street, all of New York; Charles H. Ketcham, 385 Park avenue, Yonkers, N. Y.

Colabaugh Water Co.; water supply. Capital, \$10,000. Incorporators: Eugene Frost, Croton avenue, Hudson, N. Y.; L. T. Haney, Brooklyn; H. M. Olcott, Philadelphia, Pa., and others.

Cormack Corporation; to manufacture bricks, building material, etc. Capital, \$150,000. Incorporators: John E. Corwin, Newburgh, N. Y.; Frederick Cormack and Maurice H. Cormack, Port Ewen, N. Y.; E. J. Granger and Horace S. Gould, New York.

Electric Terminal Association, Syracuse, N. Y.; real estate. Capital, \$25,000. Incorporators: Harold C. Beatty, Thomas H. Mather, Claude Bonsted, Syracuse, N. Y.

Gillette Ice Machine Company, Portland, Me.; to deal in ice, cold storage, etc. Capital, \$1,000,000. President and clerk, M. W. Baldwin; treasurer, C. E. Eaton, both of Portland, Me.

Indiana Gas and Electric Company, 419 Market street, Camden, N. J.; to manufacture gas and coke. Capital, \$5,000,000. Incorporators: W. E. Hutchinson, Robert H. Adams, Charles A. Meeker, all as above.

National Automatic Fender & Appliance Co., Kittery, Me.; electric and mechanical devices. Capital, \$1,000,000. President and clerk, H. Mitchell, Kittery, Me.; treasurer, F. C. Gilpatrick, Boston, Mass.

National Water Main Cleaning Company, Augusta, Me.; to deal in letters patent. Capital, \$1,000,000. President and treasurer, I. E. Chadborne; clerk, L. A. Burleigh, both of Augusta, Me.

Newark Arc Lamp Co., 525 Main street, East Orange, N. J.; to manufacture arc lamps and lighting apparatus. Capital, \$10,000. Incorporators: Charles L. Beck, Charles O. Geyer, F. C. Ferguson, all as above.

Civil Service Examinations

Mechanical Draftsman.—The U. S. Civil Service Commission announces an examination on Nov. 21, to secure eligibles to fill vacancies in the position of mechanical draftsman, \$1,500 per annum in the Engineer Department at large, one at Wheeling, W. Va., and the other at Chattanooga, Tenn. Apply to the U. S. Civil Service Commission, Washington, D. C., or to the Secretaries of the Boards of Examiners, for application Form 1312.

Draftsmen.—The U. S. Civil Service Commission announces an examination Nov. 20, 21, 22, to secure eligibles to fill vacancies of architectural draftsman, junior draftsman, engineer draftsman, electrical engineer and draftsman, heating and ventilating draftsman, Supervising Architect's office; junior architectural draftsman, Bureau of Animal Industry. Applications should be made to the U. S. Civil Service Commission, Washington, D. C., or to the Secretaries of the Boards of Examiners, for application form 1312.

Architectural and Structural Steel Draftsman.—The United States Civil Service Commission announces an examination on December 5-6, 1906, at the places mentioned in the accompanying list, to secure eligibles from which to make certification to fill a vacancy in the position of draftsman (architectural and structural steel), at \$125 per month, in the office of the engineer, Twelfth Light-House District, San Francisco, Cal., a vacancy in the position of architectural draftsman, \$1,380 per annum, United States Military Academy, West Point, N. Y., and vacancies as they may occur in any branch of the service requiring similar qualifications. Age limit, 20 years or over on the date of the examination. This examination is open to all citizens of the United States who comply with the requirements. Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the Secretary of the Board of Examiners at any place mentioned in the accompanying list, for application Form 1312. No application will be accepted unless properly executed and filed with the Commission at Washington. In applying for this examination the exact title as given at the head of this announcement should be used in the application. As examination papers are shipped direct from the Commission to the places of examination, it is necessary that applications be received in ample time to arrange for the examination desired at the place indicated by the applicant. The Commission will therefore arrange to examine any applicant whose application is received in time to permit the shipment of the necessary papers.

BOOK REVIEWS

Annual Report of the Comptroller of the City of Rochester, N. Y., for the Year Ended December 31, 1905.—Samuel B. Williams, Comptroller, in submitting his report to the Mayor and Common Council, states that the report includes a greater amount of detailed information than is usually given in statements of this nature. An examination of the book will verify this, and the Comptroller might have added that the information was well indexed. The general balance sheet shows Capital Assets of \$22,736,000, of which \$8,151,000 are classed as Public Industries; \$2,243,000 as Public Instruction; \$1,627,000, Parks; \$980,000, Public Safety; \$1,010,000, Bridges; \$8,159,000, Pavements and Sewers; \$129,000, Cemetery, and \$432,000, Miscellaneous. The Capital Liabilities are \$9,985,000 in bonds and some small items, leaving a Capital Surplus of \$15,458,000.

A Handbook for the Use of Sealers of Weights and Measures.—By F. Reichmann, Ph.D., Troy, N. Y. W. & L. E. Gurley, Troy, N. Y. 1906. Price, 50 cents. This handbook explains methods for inspecting and testing such weights and measures as come under the sealer's jurisdiction. Mr. D. C. V. Palmer, the Deputy State Sealer of Massachusetts, who writes a short introduction, mentions how the citizens have benefited by the work of his department; thousands of short measure milk jars are rejected by the sealers; the statement is made that a large percentage of goods are sold short measure. The author sketches the history of standards of weights and measurements. He defines the duties of a sealer, and describes suitable equipment for an office. All sorts of measures and weights in common use are described in detail, and proper methods of inspection, testing and sealing are given. Forty pages of useful tables are presented at the end of the book.

PATENT CLAIMS

832,919.—Asphalt-Cutting Mechanism. John C. Mertens, Chicago, Ill., assignor of one-half to Joseph Hanreddy, Chicago, Ill. Serial No. 313,013.

In a device of the class described, the combination of guide-rails, a supporting-plate a feed-screw around which the supporting-plates can be moved as a pivot, mechanism carried by the supporting-plate for actuating the feed-screw, and a cutter at the end of the feed-screw, substantially as described.

832,937.—Hydrant. George F. Voigt, Jeffersonville, Ind. Serial No. 279,521.

In a hydrant, the combination with a shell, a tubular valve-rod provided with a bell, and a water-main having an elbow below the shell, of a flat closure-plate having an upstanding peripheral flange secured to the exterior of the shell, and a tube concentric with the peripheral flange, said tube being formed integral with the closure-plate and piercing the central portion thereof, the upper end of said tube extending upwardly from the flat closure-plate and slidably engaging the bell, and the lower end of said tube extending downward below the flat closure-plate and slidably fitting into the elbow of the water-main.

832,964.—Construction of Buildings. Luther P. Friestedt, Chicago, Ill. Serial No. 233,440.

The method herein described for constructing underground stories, which consists in first putting in the supporting foundation-piers, next excavating to the required depth for the first story, then putting in the floor-girders, then continuing the excavation down for the second story, then putting in the floor-girders therefor, and so on continuously in accordance with the number of stories to be located underground, thereby making each floor-framing a rigid brace against any lateral pressure or thrust.

LEGAL NEWS

A Summary and Notes of Recent Decisions
—Rulings of Municipal Interest

Damages and Earnings

Kronold vs. City of New York.—The action was brought to recover damages for personal injuries sustained by the plaintiff and alleged to have been caused by the negligent failure of the defendant to keep in proper repair a crosswalk in the borough of Manhattan. It was held that in an action for personal injuries sustained by one whose income depended largely upon his personal efforts and activity in his business, which he carried on alone, the plaintiff may recover, as an item of damages, the values of his earnings and income, even though the investment involved but a small amount of capital. Exclusion of evidence of the value of his personal earnings and income in such a case is held to be reversible error.—Court of Appeals, New York City.

Party Wall Not Dangerous

District of Columbia vs. Mattingly.—The appellee having failed to comply with a demand for the removal of a party wall between his premises and those of the adjoining proprietor, a Board of Survey was chosen under the provisions of an act to determine the question of whether or not the wall in question was a dangerous structure within the meaning of the statute. The appellee refused to remove the wall as ordered by the Board of Survey, and denied the right of the District Commissioner to remove it or to charge him with the cost of removal. The District authorities proceeded to remove and rebuild the wall, and assessed a considerable portion of the expense against his property. The lower court quashed the assessment and the Court of Appeals affirms this judgment, holding that the finding of the Board of Survey did not show the wall in question to be a dangerous structure.—Court of Appeals, District of Columbia.

Exercise of Discretion

O'Leary vs. Tenement House Commission.—O'Leary sought to mandamus the department to approve plans for tenement houses which showed an L-shaped parlor. This room or alcove was not provided with a window, and for this reason was disapproved by the department. The court has refused to intervene, and will not interfere with the judicial discretion of the Tenement House Commissioners.—Supreme Court, New York, N. Y.

WHO'S WHO IN
MUNICIPAL WORK

COTTINGHAM, Charles.—Civil Engineer; born at Independence, Ind., in 1860. Graduated from the Department of Civil Engineering of Purdue University in 1892; received the degree of C. E. from the University of Michigan in 1897. From 1892 to May, 1896, engaged on the engineering corps of the World's Columbian Exposition, and in charge of sewer construction at Ann Arbor, Mich. For

the next two years was City Engineer of Danville, Ill. Since then in private practice, engaged upon the following work: Topographical survey and improvement records of Danville, Ill., for pavements and sewers; engineer and contractor, Rossville, Ill., trunk sewer; plans and specifications for a combined electric-light and waterworks plant for Cayuga, Ind.; plans and specifications for waterworks, Oakland, Ill., and topographic survey of same; plans and specifications for sewerage system, Le Roy, Ill.; engineer for street improvements, sewers, brick and asphalt pavements for Covington, Veedersburg and Fowler, Ind., and Hoopeston, Milford, Tilton, Gibson City and Roselawn, Ill.; constructing engineer, sewer construction, Havana, Ill., consisting of both open-cut and tunnel work; engineer to the contractor for Danville, Urbana & Champaign Electric Railroad (Illinois Traction System); constructing engineer and contractor for Seventh Ward sewer, Danville, Ill. (contract price \$29,000), consisting of one mile of 4-foot double-lying brick sewer, one mile of 18- and 24-inch pipe, and has prepared plans for electric railway, sewerage system and septic tank for Robinson, Ill., plans and specifications for system of waterworks for Donovan, Ill.; also surveys, levels, maps, profiles, estimates, reports, etc., for Saline branch drainage district; in association with Prof. I. O. Baker.—Residence, Danville, Ill.

ROMMEL, George, Jr.—Resident Engineer, Pensacola, Fla., Sewerage and Drainage System, formerly Chief Engineer, Street and Sewer Dept., Wilmington, Del. Born at Reading, Pa., in 1875. Graduated as civil engineer from the University of Pennsylvania in 1897. Was connected with the Sewer Department at Wilmington from 1891 to 1906, except during 1894 to 1899. In addition, has been engaged (as principal assistant to Mr. T. Chalkley Hatton, whom he succeeded in office in 1904) upon sewerage systems at Newport News, Va., Milford, Lewes and Seaford, Del., Coatesville and York, Pa., and on waterworks at Seaford and Lewes, Del., Newport News, Va., and Cape May, Hammonton and Matawan, N. J. Residence, Pensacola, Fla.

CONVENTION NOTES

Conference of the Boards of Health of New Jersey.—About 150 delegates assembled at the State House in Trenton, on October 19 to attend the first annual conference, in accordance with a law of the last Legislative session providing for an annual meeting to take action looking to uniformity in sanitary methods throughout the State. Formal papers were not presented, but discussions were held on the provision of isolation facilities for diphtheria and scarlet fever cases throughout the State; on the use of abandoned wells for house sewage or other waste liquids; on spraying, boiling and formaldehyde treatment for disinfecting purposes; on reporting contagious and infectious diseases and enforcing isolation; on supervision of milk supplies; on abating nuisances by legal action, and other topics. The conference was under the direction of the State Board of Health, Henry Mitchell, Secretary.

Annual Convention of the American Civic Association.—This association met

at Milwaukee, Wis., October 24-26, with an attendance considerably larger than that at Cleveland, O., a year ago. It was regarded also as one of the most successful in the history of the association. The membership and financial support were reported to have increased more than fifty per cent. during the past year. It was decided to make specially aggressive attacks on disfiguring billboards during the next year, the general plan for their extermination being to "tax them out of existence." The selection of a place of meeting was left to the Executive Committee, which probably will not decide the matter for some time.

Calendar of Meetings of Municipal
and Allied Societies

November 7.
American Society of Civil Engineers.—Meeting, 220 West Fifty-seventh street, New York City.—Paper on "Works for Purification of Water Supply, Washington, D. C."—Charles Warren Hunt, Secretary, 220 West Fifty-seventh street, New York City.

November 13-15.
Southern Immigration and Quarantine Conference, Nashville, Tenn.

November 13.
New York State Conference of Charities and Corrections.—Seventh conference, Rochester, N. Y.—Walter E. Kruesl, Secretary, 105 East Twenty-second street, New York City.

November 14-16.
International Congress on Tuberculosis.—New York City. (The principal purpose of the congress will be that of urging preventive legislation against tuberculosis, the adoption of municipal and government sanitariums and discussion of all the questions involved.)

November 15.
National Society for the Protection of Public Health and Morals.—To be organized at Hudson Theater, New York City.

November 15-16.
Deep Waterway Convention, St. Louis, Mo.—Hon. Henry T. Rainey, Secretary, Carrollton, Ill.

November 15-17.
Mississippi State Firemen.—Convention to organize an Association, Hattiesburg.—Chief A. F. Potter, Secretary, Hattiesburg, Miss.

December 3-4.
American Society of Refrigerating Engineers.—Annual meeting, New York City.—W. Everett Parsons, Secretary, 12 West 31st street, New York City.

December 4-7.
American Society of Mechanical Engineers.—Annual meeting, New York City.—F. R. Hutton, 12 West 31st street, New York City.

December 5-7.
National Association of Manufacturers of Sand-lime Products.—Third annual convention, Chicago, Ill.

December 5-7.
National Drainage Conference.—Oklahoma City, Okla.—A. W. Knead, Secretary, Oklahoma City, Okla.

December 6-7.
National Rivers and Harbors Congress.—Convention, Washington, D. C.

December 27-January 2.
American Association for the Advancement of Science.—Annual meeting, New York City.—L. O. Howard, Secretary, Cosmos Club, Washington, D. C.

January.
American Institute of Social Service.—Exposition, New York City.—Dr. William H. Tolman, Director, 287 Fourth avenue, New York.

February 15-16.
Wisconsin Gas Association.—Annual meeting.—Henry H. Hyde, Secretary, Racine, Wis.

February 22.
New England Association of Gas Engineers.—Annual meeting, Boston, Mass.—N. W. Gifford, Secretary, New Bedford, Mass.

April 18-21.
Southwestern Gas, Electric and Street Railway Association.—Annual meeting, San Antonio, Tex.—Frank C. Duffey, Secretary, Beaumont, Tex.

STREET FLUSHING MACHINE

**An Improved Sanitary Automatic Device—Used in 40 Cities
—Economical Method of Sprinkling and
Cleaning Combined**

FOR several years flushing machines have been used exclusively in a number of cities for cleaning paved streets. When the machine system was first introduced, about five years ago, the machines were necessarily somewhat crude, as are all new inventions, but the great merit of the system was quickly realized, and the demand for such a device was such that the patentees persevered, and now the Sanitary Street Flushing Machine Company, Carleton Building, St. Louis, Mo., sole owner of the Murphy patents, has placed upon the market an improved machine which it claims meets every requirement.

As shown in the illustration, the nozzles are placed back of the rear wheels, preventing waste of water or force from contact with the wheels and allowing the horses to travel dry shod. A flushing nozzle is located back of either rear wheel, which enables the machine to flush a street from either side. The tank is built of the best boiler steel, and its capacity is 600 gallons. It is mounted on a four-wheel truck, constructed in the most substantial manner. The tank is filled with water from fire hydrants through a hose attached to the filling valve on the rear end. The force of the water flowing through the filling valve automatically charges the air tank, direct from the fire hydrant.

When full, the machine is drawn back and forth over the street; the water is expelled against the surface of the pavement under air pressure sufficient to remove all dirt with which it comes in contact. It washes the street, depositing the dirt and other matter which was on its surface in the gutters, where it can be carted away. The water flows into the sewers, thus helping to flush them.

It is claimed by the manufacturers that the use of these machines for cleaning paved streets is economical, sprinkling and cleaning at one operation, and that they promote good health by eliminating all dust. They are in use in about forty cities throughout the country, among them



STREET FLUSHING MACHINE IN OPERATION

Cleveland, Youngstown, Ohio; Worcester, Mass.; Spokane, Wash.; San Francisco; Louisville, Ky.; Kansas City, and St. Louis.

In a handsome folder recently published, the firm reproduces letters from all the cities mentioned above and a number of others, expressing entire satisfaction with results obtained.

THE GIBBS FIRE ESCAPE SYSTEM

THIS system consists of an endless steel link chain with certain attachments, suspended from a bolt near the top of a building at the side of a vertical wall ladder. The chain is provided with steel belts to which passengers may be attached and lowered while a friction brake insures a safe speed. The wall ladder is for the use of



GIBBS FIRE ESCAPE

firemen. The endless escape chain, having a tensile strength of 2,600 pounds, works freely until a speed of 140 feet per minute is attained, when friction begins to be applied. The machine is designed to allow one person to descend at the rate of 300 feet per minute, while the weight of a second person will only increase the speed to 310 feet; this arrangement is calculated to deliver six passengers per minute from an elevation of 50 feet. The advantages claimed for the machine are: The cost of complete equipment is less than the cost of stairway equipment; two policemen or firemen can rescue more persons than ten could carry down a stairway; it affords a quick means of raising a hose to the top of a building—as shown in the illustration.

ELECTRIC MULE IN INDUSTRY

AMONG the mechanical devices used for conveying materials, the electric mule, invented by Richard Lamb, C.E., and placed on the market by the North Penn Iron Co., North Penn Junction, Philadelphia, Pa., holds an important place. The principle upon which the "electric mule" is designed is as follows: An overhead cable—the size of which is dependent upon the greatest clear span and the nature and quantity of the material to be handled—supports the carriage, which is hung from a two-wheel trolley, the wheels of which are grooved to fit the cable. The carriage frame, pivoted in such a way that it can maintain a vertical position regardless of the grade being traversed, contains a driving motor, geared to a grooved sheave wheel, about which a light steel cable is wrapped



THE LAMB ELECTRIC MULE

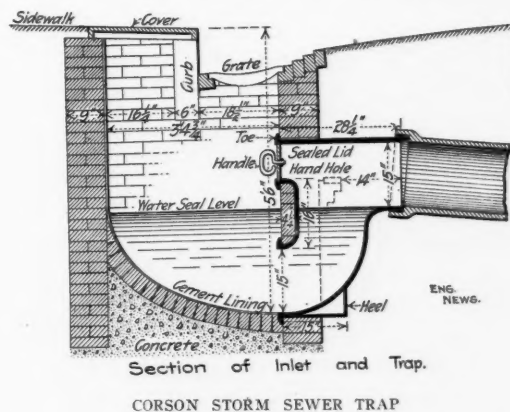
several times and anchored at both ends of the line. The cables are supported by brackets, clearly shown in the above illustration, and insulated in such a way that short-circuiting is impossible.

The economic advantages claimed for the electric mule are: Low cost of operation, hoisting and trolleying being under control of one man; low first cost, a cable-way being considerably cheaper than the accepted type of heavy steel bridge; minimum cost of current, consumption only taking place while the machine is actually in use.

CORSON STORM SEWER TRAPS

THIS trap is the invention of S. Cameron Corson, City Engineer of Norristown, Pa. It is designed for connection with a pipe of 12 to 18 inches diameter, laid generally in a trench about 3 feet 6 inches deep at the upper end. The trap may be made of cast-iron or of vitrified fire clay; but cast-iron is considered more durable, especially when used so close to the street surface as is shown in the sketch. The hand-hole is closed by a lid so as to be airtight and cause the trap to act as a syphon, thus drawing into the sewer all sand and ordinary street deposits. Only

such materials as may be in circulation when the flood water ceases to come in volume will remain, and that is taken off at the next storm or street flushing. By taking off the hand-hole lid and inserting an ordinary rain conductor the foul water can be bailed or pumped into this and so into the sewer. The hand-hole is also of use in cleaning out the sewer direct in case of necessity by inserting a fire hose from a fire hydrant. A standard 10-foot radius inlet and grate complete as shown, costs about \$75 in Norristown; \$17.00 being for brick, \$5.50 for cement and sand, \$11.00 for labor, \$21.80 for iron castings, \$17.20 for trap, and \$2.50 for carting the material.



CORSON STORM SEWER TRAP

In extreme cases the flow line of the main sewer may be several inches higher than the bottom of the inlet, yet drain off as in other inlets. Consequently by using this trap the inlet is properly sealed, yet a deep sewer is not necessary.



CORSON STORM SEWER TRAP; IN POSITION

Proposals

Electric Light System and Steam Plant

Rock Hill, S. C.
Bids for putting in an electric light system and steam plant for lighting the City of Rock Hill, S. C., population 8,000. Contracts must be closed not later than December 1, and plant ready for operation June 10, 1907.
C. S. MAY, City Clerk.

Stone Road

NOTICE TO CONTRACTORS

Sealed bids will be received by the Board of Freeholders of the County of Middlesex and State of New Jersey, on Wednesday, November 21, 1906, at the hour of eleven o'clock in the forenoon in the Court House in the City of New Brunswick, in the County of Middlesex, for the construction of a stone road according to plans and specifications (no partial bids will be received) on file in the office of the County Engineer, L. C. N. Brogger, Jr., at Perth Amboy, N. J.

The road to be improved is designated as follows: CHEESEQUAKE CREEK ROAD.—Beginning at the end of the macadam road at Cheesequake Creek bridge, and from thence on an easterly course to the Monmouth County Line. Distance, two (2) miles. The work must be commenced when the said board shall determine and must be completed September 1, 1907.

All bids must be made upon the blank proposals furnished by the County Engineer.

FRANK H. POWNALL,
Director Board of Chosen Freeholders of the County of Middlesex.

M. IRVING DEMAREST, Clerk.

Grading

Brookhaven, Miss.
Bids will be received by the Natchez & Eastern Railroad Company, at the office in Brookhaven, Miss., for the grading of about twenty-one miles of the roadbed, in Franklin County, Miss., between the Homochitto River and Wells Creek near Roxie. The profile and specifications can be seen at the office of the Chief Engineer in Brookhaven.

Bonds for \$26,200

State of South Carolina,
Greenville County.

Notice.

Notice is hereby given that the County Board of Commissioners for Greenville County will on Monday, the 19th day of November, 1906, at twelve o'clock, at Greenville Court House, County of Greenville, and State of South Carolina, sell to the highest bidder for cash the following bonds, to be issued by said Board of County Commissioners, to-wit: The bonds of the township of Dunklin, in the County of Greenville, for a sum not exceeding Fifteen Thousand Seven Hundred Dollars.

The bonds of Oaklawn township, in the County of Greenville, not exceeding the sum of Ten Thousand Five Hundred Dollars.

The said bonds will be twenty-year coupon bonds, bearing interest at the rate of four and one-half and not exceeding five per cent. per annum, payable semi-annually. Five Hundred Dollars on behalf of each township to be retired annually.

The validity of the said bonds have been passed upon and declared both by the Supreme Court of this State, and the United States Supreme Court.

All persons bidding on said bonds will be required to deposit a certified check in the sum of One Thousand Dollars, payable to the Board of County Commissioners for Greenville County. All bids to be sealed and must be in the hands of the County Board of Commissioners on or by twelve o'clock of the day of sale.

Steel Water Tanks

FORT MONROE, VA., OCT. 24, 1906.—Sealed proposals, in triplicate, for the construction of a 50,000-gallon steel water tank, at Ft. Monroe, Va., will be received at the office of the Constructing Quartermaster until noon, November 15, 1906. The United States reserves the right to accept or reject any or all the proposals, or any part thereof. Bidders must state name of manufacturers they propose to purchase supplies from. Information furnished on application. Bids should be plainly marked as such on outside wrapper or envelope. Address Captain R. H. C. KELTON, Q. M.

Pumping Engine

Brockton, Mass.
Sealed proposals, endorsed "Proposals for Pumping Plant," will be received at the office of the Water Commissioners, City Hall, Brockton, Mass., until 12 o'clock noon on Wednesday, November 21, 1906, for furnishing and erecting complete, on foundations furnished by the city, one vertical triple-expansion condensing, crank-and-flywheel pumping engine of six million gallons' daily capacity.

Each proposal must be accompanied by a certified check drawn and made payable to the City of Brockton, for the amount of one thousand (\$1,000.00) dollars.

THOMAS G. NYE,
FRANCIS B. GARDNER,
HORACE KINGMAN,
Water Commissioners.

CHARLES R. FELTON, City Engineer.

Sewage Purification Works

Washington, Pa.
Proposals for the construction of municipal sewage purification works will be received by the town council of the Borough of Washington, Pa., until 12 o'clock M., Monday, November 19, 1906.

Proposals must be made on blank forms, which, with copies of plans and specifications, will be furnished on application to O. K. Taylor, borough engineer.

A fine ledge of limestone, suitable for filtration purposes, is situated upon the premises upon which said works are to be built, and bidders will be required to take this fact into consideration in submitting bids.

J. K. WEIR,
Clerk of Council.

Sewers

OFFICE, COMMISSIONERS DISTRICT OF COLUMBIA, Washington, Oct. 27, 1906.

Sealed proposals will be received at this office until 12 M., November 27, 1906, for constructing sewers in the District of Columbia. Forms, specifications and necessary information may be obtained at Room 43, District Building, Washington, D. C.

HENRY B. F. MACFARLAND,
HENRY L. WEST,
JOHN BIDDLE,
Commissioners, D. C.

Asphalt Plant

Office of the President of the Borough of Brooklyn, Room No. 15, Municipal Building, Borough of Brooklyn, the City of New York.

Sealed bids or estimates will be received by the President of the Borough of Brooklyn at the above office until 11 o'clock A.M. on Wednesday, November 21, 1906, for furnishing, delivering and erecting an asphalt plant.

Time for the delivery of the materials and the full performance of the contract is on or before April 1, 1907.

The amount of security required is five thousand dollars (\$5,000).

The bidder will state the price of each item or article contained in the specifications or schedules herein contained or hereto annexed, per linear foot, foot board measure, cubic yard, or other unit of measure, by which the bids will be tested.

The bids will be compared and the contract awarded at a lump or aggregate sum for each contract.

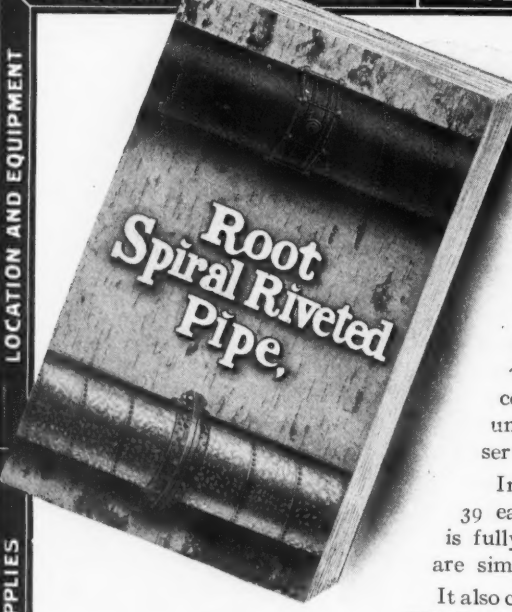
Blank forms and further information may be obtained and the plans and drawings may be seen at the office of the Assistant Commissioner of Public Works, the Borough of Brooklyn, Room No. 15, Municipal Building, Borough of Brooklyn.

BIRD S. COLER, President.

Street Paving

Sealed proposals in duplicate will be received by the City Treasurer of Montgomery, Alabama, until 12 o'clock noon Wednesday, November 28, 1906, for paving and otherwise improving Montgomery street, from Moulton street to Goldthwaite street, with vitrified brick, bitulithic or asphalt; for paving and otherwise improving Caroline street, from Clayton street to Mildred street, with either vitrified brick, bitulithic or asphalt; for paving and otherwise improving Wilson street, from Sayre street to Court street, with either vitrified brick, bitulithic or asphalt; for paving and otherwise improving Goldthwaite street, from Montgomery street to Mildred street, with either vitrified brick, bitulithic or asphalt; all according to plans and specifications on file in the office of the City Engineer. City reserves the option of paying in cash or with bonds with accrued interest. Certified check on a bank in the sum of \$250 on each street to accompany each bid. City reserves the right to reject any and all bids.

R. S. WILLIAMS, City Treasurer.

PRICES AND	SIZES	SPECIAL ADVANTAGES
 <h1 style="font-size: 4em; margin: 0;">Pipe Facts</h1>		
<p>The intelligent ordering of ROOT SPIRAL RIVETED PIPE has always seemed difficult owing to the many gauges, coatings and joints used under varying conditions of service and pressure.</p> <p>In our new Hand-book No. 39 each detail of construction is fully explained and all lists are simplified.</p> <p>It also covers the ROOT WATER TUBE BOILER, EXHAUST HEADS, FOOT VALVES, and such HYDRAULIC APPLIANCES as we manufacture for placer mining.</p> <p style="text-align: center;"><i>Sent postpaid on request</i></p> <h2 style="text-align: center;">ABENDROTH & ROOT MFG. CO.</h2> <p style="text-align: center;">Main Office and Works, NEWBURGH, N. Y.</p> <p style="text-align: center;">Branches—</p> <p style="text-align: center;">NEW YORK PITTSBURGH CHICAGO MEXICO CITY</p>		
ROOT WATER-TUBE BOILERS		EXHAUST HEADS

LOCATION AND EQUIPMENT
SHEET IRON AND PLATE WORK
PUNCHED AND FORMED SHEETS
HYDRAULIC MINING SUPPLIES